TM 1-460

U.S. WAR DEPARTMENT

TECHNICAL MANUAL

RADIOTELEPHONE PROCEDURE AIR CORPS

March 21, 1941

TECHNICAL MANUAL
No. 1–460

WAR DEPARTMENT,
WASHINGTON, *March 21, 1941.*

RADIOTELEPHONE PROCEDURE, AIR CORPS ★★

Prepared under direction of the Chief of the Air Corps

293880°—41——1

SECTION I

GENERAL

1. General.—The tendency to use the voice in radio communication has, during the past few years, increased considerably. The radiotelephone is not only employed for command and general communication purposes, but its use is even being extended to include liaison communication, at least up to the point where radio telegraph must be used to obtain accuracy and dependability under conditions unfavorable to voice communication. In radiotelephone communication, the accuracy with which messages are received depends on the transmitting operator's clearness of speaking, that is, his enunciation.

2. Enunciation.—Correct understanding of all speech over the radio must be effected through good, clear enunciation. Loud talking into the microphone is unnecessary. The normal tone of voice should be used. The gain control on the transmitter will raise or lower the voice to the proper modulation level. Reading aloud at home or in a deserted corner of the barracks is an excellent form of practice. Consideration of the enunciation of others will prove interesting as well as instructive.

3. Continuity.—A uniform flow of language without hesitation is necessary in order that each word may be heard with equal strength. The position and distance of the speaker from the microphone should not be changed during a transmission. If for any reason it becomes necessary for the operator to change his position or turn his head, speech should be suspended until the proper position has been resumed. Each syllable of each word should be enunciated clearly, and numerals especially should be spoken distinctly. A slight pause between the word preceding and following numerals accentuates the figure which is the vital information intended for the pilot.

4. Speech rate.—Radiotelephone transmissions will be performed at a rate which if necessary will permit the receiving operator to copy the transmission verbatim. (Operators at Civil Aeronautics Administration (CAA) stations transmit scheduled broadcasts at a rate of 120 words per minute.)

5. Superfluous transmissions.—A radio frequency channel is equivalent to a telephone line in many respects. Unnecessary transmissions will be avoided in order to minimize interference. Radiotelephone transmissions will be made in a concise and business-like manner and in a normal conversational tone of voice without undue fluctuation. The tendency to raise the voice level and pitch and to speak excitedly should be avoided, as transmissions in a calm, clear, conversational manner are more readily understood.

6. Corrections.—Occasionally an operator may make a mistake in reading reports or information into a microphone. If this happens, the erroneous report must be corrected before continuing. Speech should be stopped immediately, the words "Erase, erase, erase" spoken, and the correct version of what was to be said should be stated. If necessary, the whole sentence should be repeated in order that the receiving operator may receive all the information intended for him.

7. Repetition.—If the receiving operator did not receive the information intended for him, he will call the station and ask for a repetition, thus: "Repeat all"; "Repeat all after_____"; "Repeat _____". (Dotted line indicates any missing portion.)

8. Stand by.—As mentioned in paragraph 3, it is necessary that the flow of language be continuous. If for any reason this is impossible, the word "Wait" should be used.

9. Profanity.—The use of profanity and obscene language on the air is forbidden. It is both a court-martial and a Federal offense.

10. Calls and replies.—*a.* To establish communication the initial call-up will be made once as indicated in the example below. If no reply is heard within 30 seconds a second call-up is made, this time the call-up is made twice. The double call-up will be repeated at 1-minute intervals until communication is established. If no reply is heard, the operator will use judgment as to whether or not he should continue calling.

Item	*Example*
Designation of station called	"ARMY EIGHT FIVE ZERO SIX"
The word "From"	"FROM"
Designation of calling station	"SCOTT ARMY AIRWAYS"

Invitation to reply	"ANSWER"

b. Communication will be initiated by call-up and answer when—

(1) Communication has not been established.

(2) Previous contact has been terminated.

11. Acknowledgment of receipt.—The word "ROGER" will be utilized by a receiving station to acknowledge receipt of a radiotelephone message.

Item	*Example*
Designation of station called	"ARMY EIGHT FIVE ZERO SIX"
The word "From"	"FROM"
Designation of calling station	"SCOTT ARMY AIRWAYS"
Acknowledgment	"ROGER"

12. Advice of compliance.—The phrase contraction "WILCO" (Will Comply) will be utilized to indicate that the receiving station will comply with orders or requests contained in a message received from the sending station. When utilized, this phrase contraction will take the place of the acknowledgment "ROGER" as stated in paragraph 11.

13. Termination of communication.—Transmissions may be terminated by one of the following:

a. "ANSWER" applies only when establishing communication.

b. "GO AHEAD," which requires a reply even though it be merely an acknowledgment or receipt.

c. "REPEAT," when instructions or information have not been understood.

d. "WAIT," which indicates that a return call will be made as soon as practicable.

e. "ROGER," acknowledgment of receipt.

f. "WILCO" (Will Comply), statement of forthcoming compliance with an order or request.

g. "THAT IS ALL," which indicates the end of communication.

14. Reopening of communication.—Reopening of communication, once closed, requires a complete new call-up.

15. Statement of figures.—All figures will be spoken individually except those utilized to indicate ceiling heights, flight levels, upper air levels, etc. These figures in numbers smaller than 10,000 will be spoken in even hundreds and thousands of feet. These figures in the number 10,000 and larger numbers will be spoken as, for example,

"TWELVE THOUSAND" repeated immediately as "ONE TWO THOUSAND."

Number	Statement
500	Five hundred.
1, 300	One thousand three hundred.
4, 500	Four thousand five hundred.
10, 000	Ten thousand, one zero thousand.
13, 000	Thirteen thousand, one three thousand.
18, 143	One eight one four three.
22, 000	Twenty two thousand, two two thousand.

16. Statement of time.—Time will be stated in exactly four figures utilizing the 24-hour clock basis. The hour will be stated by the first two figures and the minutes by the last two figures.

Time	Statement
0000 (midnight)_____	Zero zero zero zero.
0920 (9:20 a. m.)____	Zero nine two zero.
1200 (noon)_____	One two zero zero.
1643 (4:43 p. m.)____	One six four three.

Midnight is 0000, never 2400. The last hour of the 24-hour clock day begins at 2300. The last minute of the hour begins at 2359 and ends at 0000, which is the beginning of the first minute ending at 0001 of the first hour of the next day.

SECTION II

WEATHER

17. General.—The safety of air navigation depends very much on weather conditions. Poor visibility and low ceilings are the pilot's greatest hazards. Before departing for a particular destination it is essential that the pilot know existing weather conditions en route and at his destination.

18. Schedule of observations.—The Civil Aeronautics Administration and the United States Weather Bureau operate and maintain weather reporting stations throughout the United States. These stations are linked by teletype circuits. All stations make a weather observation and transmit it on the teletype circuit 35 minutes after each hour throughout the day and night.

19. Special weather reports.—In addition to hourly reports, the stations report changes in weather by means of a special weather report which is transmitted as soon as possible on the teletype circuit. The actual changes and limits thereof are beyond the scope of this course. A special weather report is mentioned to acquaint the student with the fact that a change of some sort has

taken place. By watching the reports from a particular station, the changes will be noted by either addition or omission of information in the previous report.

20. Requirements of radio operator.—An Air Corps radio operator is required to know enough about weather symbols and regulations to copy intelligently weather information as broadcast by radio range stations, Army airways stations, or any other source. In addition, he must be able to take weather reports off a teletype circuit and broadcast them at a rate of 120 words per minute, plus or minus five percent. The speed will not be below the minimum of 114 words per minute, nor will it exceed a maximum of 126 words per minute.

21. Composition of weather report.—Paragraphs 22 to 38, inclusive, describe each item of a weather report in the order in which it appears in the report.

22. Ceiling.—A ceiling as pertains to weather is the base of an overcast cloud or of broken clouds. Scattered clouds do not constitute a ceiling. If more than one layer of clouds is observed and reported, the base of the lower clouds is the ceiling. The ceiling height and height of scattered clouds are written in hundreds of feet.

Example:

40⊕12◑ Ceiling 4,000 feet, overcast, scattered clouds at 1,200 feet.

23. Ceiling unlimited.—The ceiling will be reported unlimited when—

a. The sky is clear.

b. There are scattered clouds.

c. The base of the clouds is more than 9,750 feet above the point of observation.

d. There is a combination of conditions *b* and *c* above. (See par. 28.)

When the ceiling is unlimited, the figures to indicate the height of the ceiling are omitted from the report.

Example:

−⊕/ Ceiling unlimited, high thin overcast.

24. Modifying signs for ceilings.—*a.* When the number itself appears indicating height of ceiling, it indicates that the ceiling has actually been measured.

Example:

23⊕ Ceiling 2,300 feet, measured.

b. When the letter "E" precedes the figure indicating height of ceiling, it means that the ceiling has been estimated by the weather observer.

Example:

E65◑ Base of broken clouds estimated 6,500 feet.

c. When the letter "V" follows the ceiling value, it indicates that the height of the ceiling is variable. The modifying symbol V is used only

when the ceiling is below 2,000 feet. When the ceiling is above 2,000 feet, variations are not reported.

Example:

E5V Ceiling estimated 500 feet, variable.

d. When the plus sign precedes the height of ceiling, it indicates that the ceiling is more than the figure given. Often a ceiling balloon is blown out of sight before it enters the clouds. The height of the balloon when last observed will be reported.

Example:

+18⊕ Ceiling more than 1,800 feet.

25. Sky conditions.—Sky conditions refer to clouds. Clouds constitute ceilings. Therefore, the ceiling will depend on sky conditions. They are very closely associated. In order to explain all items of a weather report in sequence, a few sky symbols dealing with ceilings have been included before an explanation of the symbols (pars. 26 to 28, incl.).

26. Sky symbols.—There are four basic sky symbols, often referred to as cloud symbols. These symbols with corresponding pronunciations indicate sky conditions as follows:

○ "CLEAR"—sky either clear of clouds or partly covered by clouds. The maximum amount of sky that can be covered by clouds is less than one tenth.

◔ "SCATTERED CLOUDS"—from one tenth to five tenths, inclusive, of sky covered by clouds.

◍ "BROKEN CLOUDS"—more than five tenths but not more than nine tenths of sky covered by clouds.

⊕ "OVERCAST"—more than nine tenths of sky covered by clouds.

27. Modifying basic symbols.—*a.* The slant (/) following a cloud symbol indicates high clouds, that is, those more than 9,750 feet above the point of observation.

b. The plus sign preceding a cloud symbol indicates dark clouds.

c. The minus sign preceding a cloud symbol indicates thin clouds.

d. Examples:

◍/ High broken clouds.

+⊕ Dark overcast.

−◔ Thin scattered clouds.

−⊕/ High thin overcast.

28. Reporting more than one layer of clouds.—*a.* When two layers of clouds are observed they are reported as follows:

⊕/◍ "HIGH OVERCAST, LOWER BROKEN CLOUDS"—high layer of clouds more than 9,750 feet above point of observation and lower layer below this level. The base of the lower level is indicated as the ceiling.

⓪/⓪ "HIGH SCATTERED, LOWER SCATTERED CLOUDS"—high layer above 9,750 feet and lower layer indicated in hundreds of feet. ***Caution:*** In this case there is no ceiling, and it is reported as unlimited.

⓪⓪ "BROKEN, LOWER BROKEN CLOUDS"—higher layer of clouds below 9,750 feet and lower layer indicated as ceiling.

b. Several combinations of sky symbols will be found in appendix IV.

29. Visibility.—"Visibility", as defined by the Weather Bureau, is the mean greatest distance toward the horizon that prominent objects, such as mountains, buildings, towers, etc., can be seen and identified by the normal eye unaided by special optical devices, such as binoculars, telescopes, glare-eliminating goggles, etc., and which distance must prevail over a range of half or more of the horizon.

30. Reporting visibility.—Visibility will be reported as—

0 Zero.
⅛ One eighth mile.
⅕ One fifth mile.
¼ One quarter mile.
½ One half mile.
¾ Three quarters mile.
1 One mile.
1½ One and one half miles.
2 Two miles.
3 Three miles.
4 Four miles.
5 Five miles.
6 Six miles.
7 Seven miles.
8 Eight miles.
9 Nine miles.

If the visibility is more than 9 miles, it is reported as "visibility more than nine miles." If a weather report does not indicate the visibility, the fact that it is omitted will indicate that the visibility is more than 9 miles.

31. Weather element.—The "weather element" as defined by the Weather Bureau consists of those phenomena occurring in connection with active or imminent precipitation, or meteorological disturbances of more or less localized extent and effect. This element includes the occurrence of all rain, snow, sleet, hail, freezing, rain, etc., and all thunderstorms, squalls, tornadoes, etc. (See app. I.)

32. Obstruction to vision.—*a. General.*—Weather in many cases is an obstruction to vision. In addition there are conditions, such as dust, smoke, haze, or any other visibility limiting factor, which cannot be classified as weather. The weather element and obstruction to vision are grouped together in a weather report.

b. Weather symbols and obstruction to vision symbols.—Symbols and definitions for weather elements and obstruction to vision as used in weather reports will be found in appendix I. To be efficient in handling weather reports all the symbols must be learned.

33. Barometric pressure.—*a. General.*—Barometric pressure at any level is a measure of the weight of the vertical column of air of unit cross section above that level. For purposes of uniformity and comparison all pressures are reduced to sea level. Accurate data concerning barometric pressure are of high importance to the forecaster in preparation of his weather maps and forecasts. Pressure is reported in millibars and tenths of millibars but is not broadcast unless specifically requested.

b. Station pressure.—This is the actual barometric pressure at the station.

c. Sea level pressure.—This is the sum of the station pressure and the pressure of an imaginary column of air between the station and sea level. Tables for the latter have been worked out for various stations.

d. Method of reporting.—The barometric pressure is indicated by a group of three figures; the first two figures represent the tens and units of millibars, and the last the tenths of a millibar involved. Thus, a pressure of 987.2 millibars would be sent as "872"; 1001.5 as "015"; 1000.00 as "000"; etc. The values for barometric pressure are reported immediately preceding the value for temperature.

34. Temperature.—The temperature of the air is of interest and importance in flying operations from the viewpoint of determining whether icing conditions will exist, determining the mixture ratios for operations of aircraft engines in taking off and landing, being prepared for slow or fast landings according to whether air immediately over the airport is unusually heated or unusually cold, etc. Also it is extremely important in airway and other forecasting work. Accordingly it is essential that it be reported properly.

35. Dew point.—The dew point is that temperature to which a given mixed volume of air and vapor must be reduced before saturation occurs. After further reduction of the temperature there results condensation of some of the moisture in the form of dew, fog, frost, clouds, or precipitation. Knowledge of the moisture content of the air is of extreme importance to forecasters, pilots, and others in

anticipating the formation of fog, thunderstorms, cloudiness, etc. It is obvious that the dew point in a weather report will never be higher than the temperature.

36. Wind.—*a. General.*—Wind is the horizontal or nearly horizontal natural movement of air with any degree of velocity. Vertical movements of air are not considered as wind but as air currents.

b. Direction.—The direction of the wind is reported to 16 points of the compass. In weather reports the wind is reported by means of arrows that fly with the wind. For a chart of arrows and definitions see appendix II.

c. Velocity.—The velocity of the wind is reported in miles per hour. The velocity may be modified by using the minus sign to indicate fresh gusts, the plus sign to indicate strong gusts. These modifying signs follow the velocity in a report. If there is no wind blowing and a calm exists, the letter "C" will take the place of the velocity and will be announced as "Calm."

d. Estimating velocity.—Occasionally an anemometer fails and it is necessary to estimate the wind velocity. In this case the letter "E" following the velocity will indicate that the wind has been estimated. For a table of wind velocity equivalents see appendix III.

37. Altimeter setting.—*a. Definition.*—The "altimeter setting" as defined by the Weather Bureau is a pressure, in inches, used for setting a pressure-scale type sensitive altimeter in an airplane so that upon landing of the airplane at an airport the pointers of the instrument will indicate very closely the field elevation above sea level, provided the instrument is functioning properly and is free from error, and that the setting was determined by a properly equipped station near the time and place of landing, and was furnished to the pilot just prior to landing.

b. Method of reporting.—Weather reports will contain an altimeter setting which may appear as 998. This actually means that the altimeter setting is 29.98 inches. The report "014" is read as "three zero one four" and indicates a pressure of 30.14 inches. Only the last three numbers of the altimeter setting appear on reports. The operator will include the missing portion. If the number is large, two will be added and if the number is small three will be added: for example, 974 is read, "two nine seven four"; 032 is read "three zero three two."

c. Importance.—The importance of the altimeter setting and its proper reporting cannot be overemphasized. A pilot coming down through an overcast has no means, other than the altimeter, of knowing how close he is to the ground.

38. Remarks.—*a. General.*—A space is provided at the end of a weather report for remarks concerning the report itself. It is used to amplify any portion of the weather report which cannot be included in the report proper.

b. Examples of remarks.

+◍ OBSCG MTNS	HEAVY CLOUDS OBSCURING MOUNTAINS.
◍ ALG MTNS	CLOUDS ALONG MOUNTAINS.
◍ TPG MTNS	CLOUDS TOPPING MOUNTAINS.
60⊕	OVERCAST ESTIMATED AT 6000 FEET. USED WHEN ⊕◍ APPEARS IN THE BODY OF THE REPORT AND THE HEIGHT OF THE OVERCAST MUST THEREFORE BE INDICATED IN REMARKS.
3◍	LOWER SCATTERED CLOUDS AT 300 FEET. USED WHEN IT IS NECESSARY TO INDICATE A THIRD LAYER OF CLOUDS.
+⊕NW	DARK CLOUDS NORTHWEST.
◍ TURBT	CLOUDS TURBULENT.
2F NW	FOG BANK TO NORTHWEST, VISIBILITY 2 MILES.
3K NE	SMOKY TO THE NORTHEAST, VISIBILITY 3 MILES.
T APCHG SW	THUNDERSTORM APPROACHING FROM THE SOUTHWEST.
RQ W	RAIN SQUALL TO WEST.
SW TO SW	SNOW SHOWER TO SOUTHWEST.
R+ OCNLY	RAIN OCCASIONALLY HEAVY.
RE OCNLY	SLEET OCCASIONALLY MIXED WITH RAIN.
STARS VSB THRU GF	STARS VISIBLE THROUGH GROUND FOG.
FK OCNLY	SMOKE OCCASIONALLY MIXED WITH FOG.
RANOT	RANGE FACILITIES INOPERATIVE.
BRONO	BROADCAST FACILITIES INOPERATIVE.

c. List.—The previous examples do not cover every condition but merely illustrate the method used for indicating remarks. For a list of authorized abbreviations used in weather reports and other communications on teletype circuits see appendix VIII.

39. Station designator.—Combinations of two or three letters are used as station designators. This indicates that the weather report originated at that station. For a list of station designators see appendix IX.

40. Classification of weather.—*a.* All weather observations made at controlled municipal airports will be classified according to the following limits:

(1) *Class C—contact.*—Ceiling must be 800 feet or more during daytime or 1,000 feet or more during precipitation. At night the minimum is 1,000 feet regardless of precipitation. The visibility must be 3 miles or more.

(2) *Class N—instrument.*—Below class C minimums but not below 500 feet ceiling and 1 mile visibility.

(3) *Class X—closed.*—Below 500 feet ceiling and 1 mile visibility.

b. For the purpose of determining whether clearances for Army aircraft should be contact or instrument clearances, Air Corps standards for classification of weather, except at those stations where for local reasons there are special standards established, are as indicated below:

(1) *Class C—contact.*—Ceiling must be at least 1,000 feet and visibility at least 3 miles during daylight; at night ceiling must be at least 1,500 feet and visibility at least 5 miles.

(2) *Class N—instrument.*—Ceilings and/or visibilities less than the conditions specified for contact in (1) above for day and night, respectively.

41. Wind shift data.—*a.* A wind shift is indicated whenever the wind has suddenly shifted from a southerly or easterly to a westerly or northerly quadrant, accompanied by gusty winds, rapid dew point, and/or temperature drop; in summer, usually lightning and thunder, and possibly hail and intense rain; and, in winter, snow qualls at frequent intervals and a rapid lowering or lifting of the ceiling. A westerly or northwesterly wind will continue to blow steadily after it has passed, the sky will usually clear rapidly, and the air will feel dryer and cooler, except in a mountainous region. For more detailed information on wind shift data and all weather reporting it is recommended that a copy of "Circular N, Instructions for Airway Meteorological Service, Fourth Edition, 1939" be obtained from the Government Printing Office, Washington, D. C.

b. For example of wind shift report see paragraph 42*d*.

42. Examples of teletype weather reports.

LS C ⊕/20⊕ 014/30/22→↘14/989

a. The above report will be read as: "St. Louis contact, St. Louis contact, ceiling unlimited, ceiling unlimited, high scattered, lower

scattered clouds at two thousand feet, visibility more than nine miles. Temperature three zero, dew point two two, wind west-northwest one four, altimeter setting two nine eight nine."

ID C E12⊕◐5SW— 999/28/24→↗6/972 PIREPS +ICE CLDS

b. The above report will be read as: "Indianapolis contact, Indianapolis contact, ceiling estimated one thousand two hundred feet, ceiling estimated one thousand two hundred feet, overcast, lower broken clouds, visibility five miles, light snow showers. Temperature two eight, dew point two four, wind west-southwest one six, altimeter setting two nine seven two. Pilot reports severe ice in clouds."

TH E15⊕◐9SW— 979/30/23→↘14/980

c. The above report will be read as: "Terre Haute, Terre Haute, ceiling estimated one thousand five hundred feet, ceiling estimated one thousand five hundred feet, overcast lower broken clouds, visibility nine miles, light snow showers. Temperature three zero, dew point two three, wind west-northwest one four, altimeter setting two nine eight zero."

NK X 0237E E1⊕3/4R—F— 999/52/52→↘16←0236E 937 CNDNS VRBL

d. The above report will be read as: "Newark closed, Newark closed, zero two three seven observation, ceiling estimated one hundred feet, ceiling estimated one hundred feet, overcast, visibility three quarters mile, light rain, light fog. Temperature five two, dew point five two, wind west-northwest one six, wind shift passed station at zero two three six, altimeter setting two nine three seven, conditions variable."

SECTION III

WINDS ALOFT REPORTS

43. General.—Observations of upper-air wind directions and velocities are made four times each day at about 100 points in the United States. The times of observation are approximately 5 and

11 AM and PM, eastern standard time. These reports are transmitted over the Civil Aeronautics Administration teletype circuits in regular sequences beginning at 6:04 and 12:04 AM and PM, eastern standard time.

44. Description of code used in reporting.—All winds aloft reports are sent by means of a number code wherein the wind data are given by alternate groups of 5 and 4 digits each. The number of groups representing the surface and *even* 1,000-foot levels consists of 5 digits, the first of which indicates the level. The *odd* foot levels consist of 4 digits, the number indicating the level being omitted.

45. Levels for which data are given.—The data are given, insofar as they are available, for each 1,000-foot level above sea level up to and including 14,000 feet. Wind directions are given to 36 points, that is, the direction in degrees divided by 10. Velocities are given in miles per hour.

46. Composition of report.—Complete reports consist of the following items:

a. Station designation.—This is the regular CAA two or three letter designation for the station concerned, for example, CV for Cleveland, WA for Washington.

b. Time.—75th meridian time is used for all winds aloft reports. The 24-hour clock is used in reports. Six PM eastern standard time would appear as "18."

c. Surface wind data.—This will be the 5 digit group, the first of which will always be zero such as "02216," which would indicate a surface wind direction of 220 degrees and a velocity of 16 miles per hour.

d. Upper-air wind data.—The velocity is indicated by the last two figures of each group. For velocities of 100 miles per hour or over, the direction numbers will be increased by 50 and the values above 100 indicated directly by the last two digits. For example, the group "87912" would indicate that at 8,000 feet the direction of the wind would be 290 degrees, 112 miles per hour.

47. "No observation" report.—In case an observation is not made or not received at point of transmission prior to the time of filing the report, a "no observation" report is filed, consisting of the following items:

a. Station designation.—Same as paragraph 46*a*.

b. Time.—Same as paragraph 46*b*.

c. Reason for no observation.—Use one of the following words:

PICO Low clouds, none.	PIIO, Instrument trouble, none.
PIRA Raining, none.	PIBA No balloons, none.
PISO Snowing, none.	PIFO Foggy, none.
PIHE No helium, none.	PIFI Not filed.

For example, "CXO5 PICO" would indicate that no observation was made at Cheyenne at 5:00 AM eastern standard time, due to low clouds.

48. Examples of reports.—The following report is typical:

CX18 01608 1714 81816 1820 02022 2120 22417 2525

CX18 Station at which observation was made in Cheyenne. The time of observation is 6:00 PM eastern standard time.
01608 Surface, 160 degrees, 8 miles per hour.
1714 Seven thousand feet, 170 degrees, 14 miles per hour.
81816 Eight thousand feet, 180 degrees, 16 miles per hour.
1820 Nine thousand feet, 180 degrees, 20 miles per hour.
02022 Ten thousand feet, 200 degrees, 22 miles per hour.
2120 Eleven thousand feet, 210 degrees, 20 miles per hour.
22417 Twelve thousand feet, 240 degrees, 17 miles per hour.
2525 Thirteen thousand feet, 250 degrees, 25 miles per hour.

49. Phraseology used for communication or broadcasting.

BJ11 02318 2422 22625 2728 42832 2844 62852 2967 83078 3087 03194

The above report is broken down into separate groups. The exact phraseology to be used for communication or broadcast purposes is enclosed in quotation marks.

BJ11 "Winds aloft report, one one zero zero observation, Buffalo, Buffalo."
02318 (Surface data not broadcast.)
2422 "One thousand feet, two four zero degrees, two two miles."
22625 "Two thousand feet, two six zero degrees, two five miles."
2728 "Three thousand feet, two seven zero degrees, two eight miles."
42832 "Four thousand feet, two eight zero degrees, three two miles."
2844 "Five thousand feet, two eight zero degrees, four four miles."
62852 "Six thousand feet, two eight zero degrees, five two miles."
2967 "Seven thousand feet, two nine zero degrees, six seven miles."
83078 "Eight thousand feet, three zero zero degrees, seven eight miles."
3087 "Nine thousand feet, three zero zero degrees, eight seven miles."
03194 "Ten thousand one zero thousand feet, three one zero degrees, nine four miles."

SECTION IV

RADIO CALL SIGNS

50. General.—*a.* Radiotelegraph call signs for AACS ground stations will be designated by the Chief Signal Officer.

b. Radiotelephone call signs for AACS ground stations will be designated by specific geographical names, plus the name designating the type of communication provided.

c. Control towers will be designated by the name of the field at which they are located, plus the word "tower."

Example: "Bolling tower," "Langley tower," etc.

d. Airways stations will be designated by the name of the field or name of the geographical location at which they are located, plus the words, "Army airways."

Example: "Bolling Army airways," "Medford Army airways," etc.

e. Army radio ranges will be designated by the name of the field at which they are located, plus the word "radio."

Example: "Langley radio," "Chanute radio," etc.

51. Designation of airplane call letters.—*a.* For the purpose of radio telephone reference and identification, each Air Corps airplane will be designated by not less than four numerals, to be obtained from its Air Corps serial number in the following manner: The first numeral will be the last numeral of the year in which the airplane is manufactured, the remaining three numerals to be the serial number of the airplane, using "zero" where necessary between the year designated and the serial number, to make four numerals, for example, the third airplane of 1938 serial number 38–3 would be designated by the call numerals eight-zero zero-three; the twenty-fourth airplane of the 1939 serial number 39–24 would be designated by the call numerals nine-zero two-four.

b. When an airplane serial number contains more than three numbers following the numeral designating the year, the call sign of the airplane will be determined in the same manner, by using the last digit of the year of manufacture plus the remaining numerals of the serial number. Airplane 40–1110 will have a call sign of zero-one one-one-zero, and airplane 40–12637 will have a call sign of zero-one-two six-three-seven.

c. When an airplane is more than 10 years old, the call numerals will be preceded by the letter "O," pronounced "OPTION," denoting that its first numeral indicates a year in the preceding decade. Thus,

the radio identification of 1930 airplane serial number 30–326 becomes 0–0326 in and after 1940.

Example: OPTION-zero-three two-six.

SECTION V

CONTROL TOWERS

52. General.—It is the primary responsibility of the control tower operator to observe traffic conditions around the immediate vicinity and keep pilots advised of these conditions. However, the presence of a control tower in no way relieves the pilot of an airplane of the responsibility of exercising every precaution within his power to avoid hazardous situations. In some localities it is necessary to clear local tactical or training flights by agencies other than control towers.

53. Take-off instructions.—Departing aircraft will contact the control tower for take-off instructions prior to taxiing away from the line or parking area and will not depart until advised to do so. Traffic control tower operators at Air Corps stations will include the following information in take-off instructions in the sequence given:

a. Wind direction and velocity.
b. Runway and field conditions.
c. Special instructions concerning local conditions.
d. Taxi clearance.
e. Take-off clearance.

NOTE.—Altitude of field and correct time are given only upon request of pilot.

54. Example of take-off instructions.

Ship: "Chanute tower from eight five zero six, answer."
Tower: "Eight five zero six from Chanute tower, go ahead."
Ship: "Request take-off instructions, go ahead."
Tower: "Wind east twelve E one two. Field is soft, use east-west runway. Heavy construction in progress southeast of field. Taxi to west end of east-west runway, go ahead."
Ship: "Wilco."
Ship: After taxiing to take-off position. "Chanute tower from eight five zero six is field clear, go ahead."
Tower: "Field is clear eight five zero six, take off when ready."
Ship: "Chanute tower from eight five zero six, Wilco."

55. Guarding tower frequency after take-off.—Upon departure, airplanes will remain tuned to the tower frequency for at least 5 minutes after departure, unless cleared to another frequency by the control tower.

56. Landing instructions.—An airplane approaching an Air Corps field will contact the traffic control tower when approximately 10 minutes from the field. The pilot will give his position and stand by for landing instructions. When about 1 minute from the field, the pilot will again call the tower advising him of his position. The tower will then furnish landing instructions in the following sequence:

a. Wind direction and velocity.
b. Traffic information concerning other ships in vicinity.
c. Field conditions including runway or area to be used in landing.
d. Landing sequence.

NOTE.—Altimeter setting is given only on specific request of pilot.

57. Example of landing instructions.

Ship: "Chanute tower from eight five zero six, answer."
Tower: "Eight five zero six from Chanute tower, go ahead."
Ship: "Fifteen miles north of Tuscola at two thousand feet, contact, landing at Chanute Field, go ahead."
Tower: "Eight five zero six from Chanute tower, Roger."
Ship: The ship is now about one minute from the landing field. "Chanute tower from eight five zero six, request landing instructions, go ahead."
Tower: "Eight five zero six from Chanute tower, wind southwest fifteen S.W. one five. P–40 now approaching field to land. Field is soft, use the northeast-southwest runway, you are second to land, go ahead."
Ship: "Roger." The P–40 is now on the ground.
Tower: "Nine five zero six from Chanute tower, the P–40 is now on the ground, you are now first to land, go ahead."
Ship: "Wilco."

58. Sighted aircraft in vicinity of field.—Control tower operators will initiate calls to aircraft sighted approaching the field or seen taxiing out on the field that have not previously called for instructions. The type of ship and its location may be used as its call sign for this purpose. For example:

Tower: "C39 about 4 miles south of the field from Chanute tower, go ahead." The ship does not answer. It is assumed that his transmitter is inoperative. The tower will call again thus:
Tower: "C39 about 4 miles south of the field from Chanute tower, if you are receiving me rock your wings, go ahead."

If the ship is equipped with a receiver that is in operation, the pilot will acknowledge by rocking his wings. The tower will then stand by. If the ship begins circling the field, the tower operator will issue landing instructions by radio, the pilot acknowledging by some visual signal as rocking wings. Supposing that the ship did not rock its wings upon request of the tower. The tower operator will assume then that the ship has no radio facilities. If the ship begins circling the field, the tower operator will understand this as being a signal that the ship desires to land. He will then issue landing instructions by using the light gun. A table of standard light signals for control tower operation will be found in appendix VII.

SECTION VI

CIVIL AIR REGULATIONS

59. General.—As an Air Corps operator, his value to the service will be enhanced a great deal if he has a fair knowledge of civil air regulations as pertain to air traffic rules.

60. Contact flight.—Contact flight is flight of aircraft in which the attitude of the aircraft and its flight path can at all times be controlled by means of visual reference to the ground or water.

61. Instrument flight.—Instrument flight is flight of aircraft in which the visual reference (sec. V) is not continuously available, and the attitude of the aircraft and its flight path can be controlled in part or in whole by reference to instruments only.

62. Airport control tower.—An airport control tower is an establishment properly situated and equipped to allow an operator thereof adequately to control air traffic in the immediate vicinity of the airport on or adjacent to which such airport control tower is located.

63. Civil airway.—A civil airway is a route in the navigable air

space designated by the Secretary of Commerce. It includes the area 10 miles to either side of the center of such airway.

64. Control zone.—A control zone is the air space above an area within a circle with a radius of 3 miles drawn from the center of a control airport, provided, however, that if a radio directional aid station designed to direct air traffic to the control airport is more than 3 miles from the center thereof, then the control zone is extended above an area ½ mile on each side of a line projected from the center of such airport to such radio aid.

65. Control zone of intersection.—A control zone of intersection is the air space above an area within a circle with a radius of 25 miles drawn from the center of the zone of intersection.

66. Center of control zone of intersection.—The center of a control zone of intersection is—

a. The radio range station located at an intersection of airways; or

b. The center of the intersection of the on course radio range signals projected down intersecting airways; or

c. The center of an on course signal projected down an airway at a point designated by the Secretary of Commerce.

67. Flight plan.—See paragraph 85.

68. Alternate airport.—An alternate airport is an airport, other than the point of first intended landing, specified in the flight plan, and to which the flight may be directed in case of emergency.

69. Radio fix.—A radio fix is a geographical location on a civil airway, above which the position of an aircraft in flight can be accurately determined by means of radio only (such as a cone of silence marker (Z type marker), fan type marker, or intersection of radio range on course signals).

70. Check point.—A check point is a geographical location on the surface of the land or water above which the position of an aircraft in flight can be accurately determined by means of visual reference.

71. Airway traffic control area.—An airway traffic control area is an area within the limits of designated civil airways over which a particular airway traffic control station exercises traffic control.

72. Airway traffic control station.—An airway traffic control station is a station operated by the Civil Aeronautics Administration for the purpose of air traffic control on civil airways within the jurisdiction of such station.

Section VII

RADIO RANGE STATIONS

73. General.—Ground-to-plane and plane-to-ground communication has proved to be an absolute necessity if operation of aircraft is

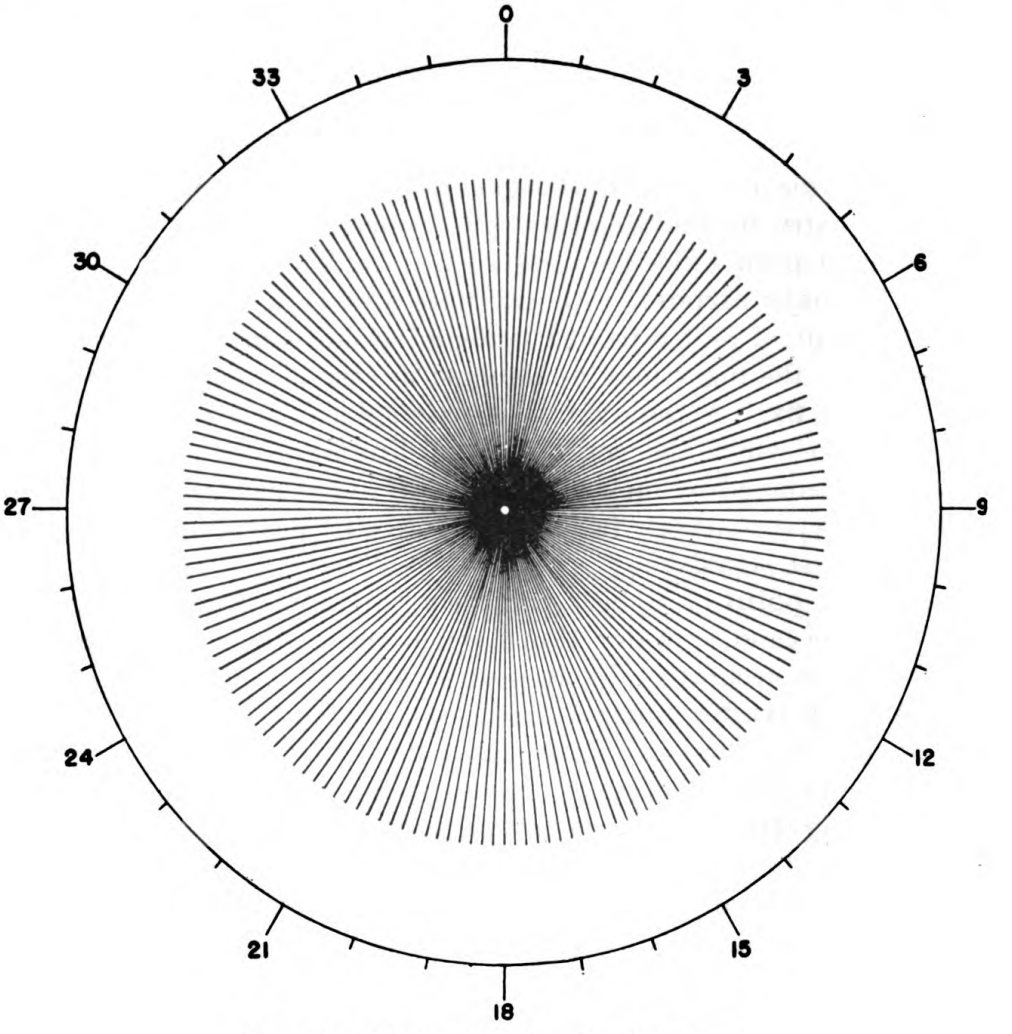


FIGURE 1.—Field strength pattern of vertical antenna.

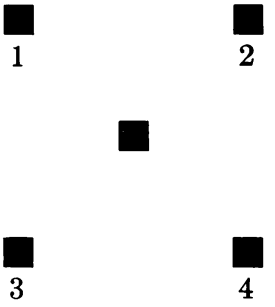
to be maintained with reliability and safety. Information relative to weather conditions along an airway is of vital importance to the

pilot who is either flying blind or over the top, or is about to take off for some particular destination. To meet this requirement the Civil Aeronautics Administration has installed and maintains radio range stations throughout the United States. These stations are located on all the airways and are the guides and markers for the aerial highways. It would be possible for a pilot to depart from Boston and fly to Seattle without ever seeing the ground, his only means of determining his position being by radio range stations.

74. Types of ranges.—There are several types of radio ranges. They all have the same task to perform—to produce a beam on which the pilot may depend to guide him safely to his destination. The type of range to be discussed in this section is the simultaneous radio range and voice transmitter using vertical radiators (Adcock system). Other types of ranges using loop antennas and tone modulated signals are being replaced by the more modern equipment.

75. Simultaneous range and voice transmitter.—The simultaneous range and voice transmitter consists of two complete transmitters operating on separate frequencies. The voice or carrier frequency is the assigned frequency of the station. The range or sideband frequency is 1,020 cycles higher than the assigned frequency. When both transmitters are on together, an audible heterodyne or beat frequency of 1,020 cycles is produced.

76. How an on course signal is produced.



In the above illustration the squares represent vertical antennas or towers looking down from above. The center tower emits a continuous uninterrupted wave on the assigned frequency. Towers 1 and 4 are connected together at the transmitter. Towers 2 and 3 are connected together at the transmitter. The range signal radio frequency power is fed to the opposite pair of towers. (See figs. 2 and 3.) The radio frequency field pattern radiated from the two sets of towers takes the form of two crossed figures of eight. (See fig. 4.) A motor-driven keying device keys the letter "N" into one pair of towers and the letter "A" into the other pair of towers. These signals are interlocked so that when received at a point along the line of equal

field intensities from both pairs of towers, the N and A signals merge to form a long dash. This constitutes an on course signal and is about 1½ degrees in width. Off course to one side or the other, either the N or the A signals predominate, since the field intensities from the two sets of towers are not equal. (See fig. 5.) Thus the system gives four courses, the spaces between the courses being termed

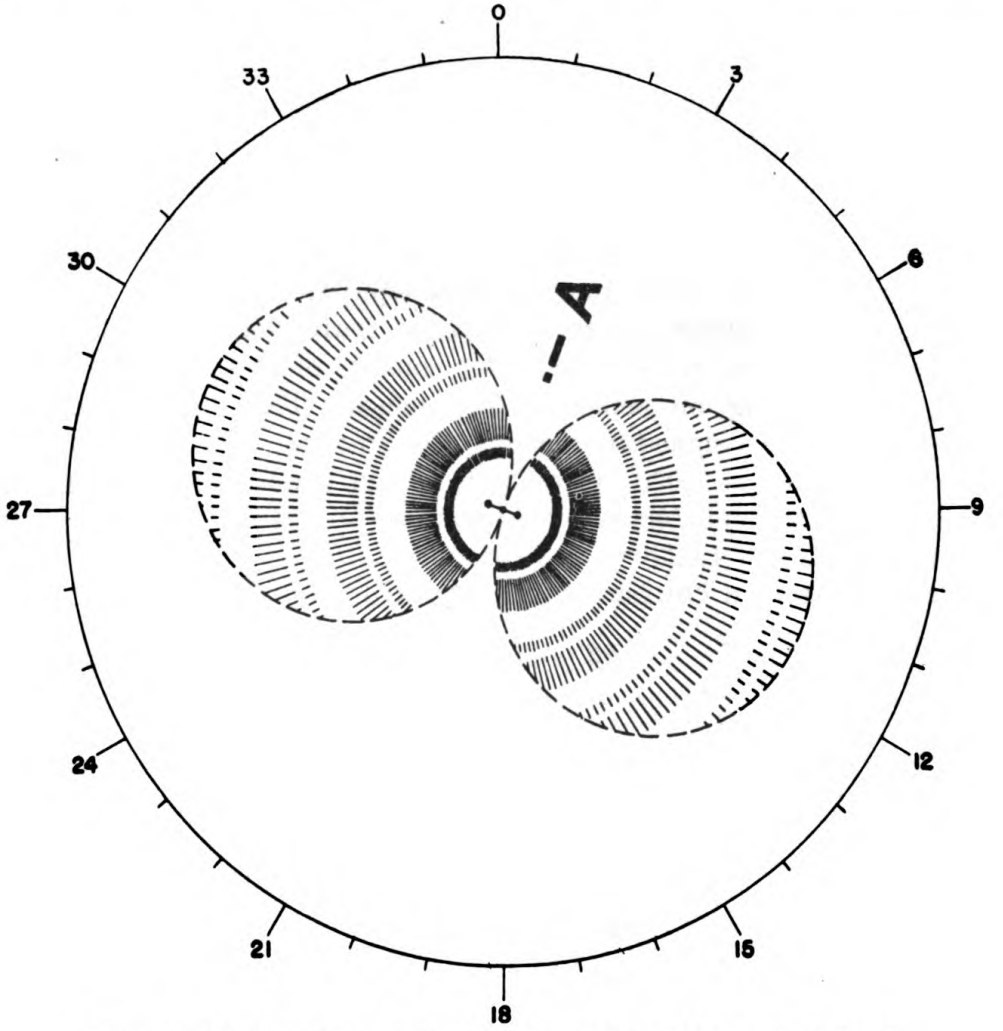


FIGURE 2.—Field strength pattern of one pair of towers into which letter "A" is keyed.

"quadrants." The interlocked signals are transmitted for approximately 29 seconds, followed by the station identifying signal which is keyed into first one pair of towers and then the other pair. The N and A signals are transmitted such that true north line always passes through an N quadrant except when a course lies due north, in which case the N lies in the northwest and southeast quadrants.

77. Frequency allocation.—Radio ranges are allocated to the frequency band of 200 to 400 kilocycles.

78. Multiple courses.—Multiple or split courses are false on course indications which occur in the transmission of most radio ranges located in mountainous territory. These multiple courses manifest themselves as on course signals at points where either the A or the N signals should predominate and may be misconstrued by

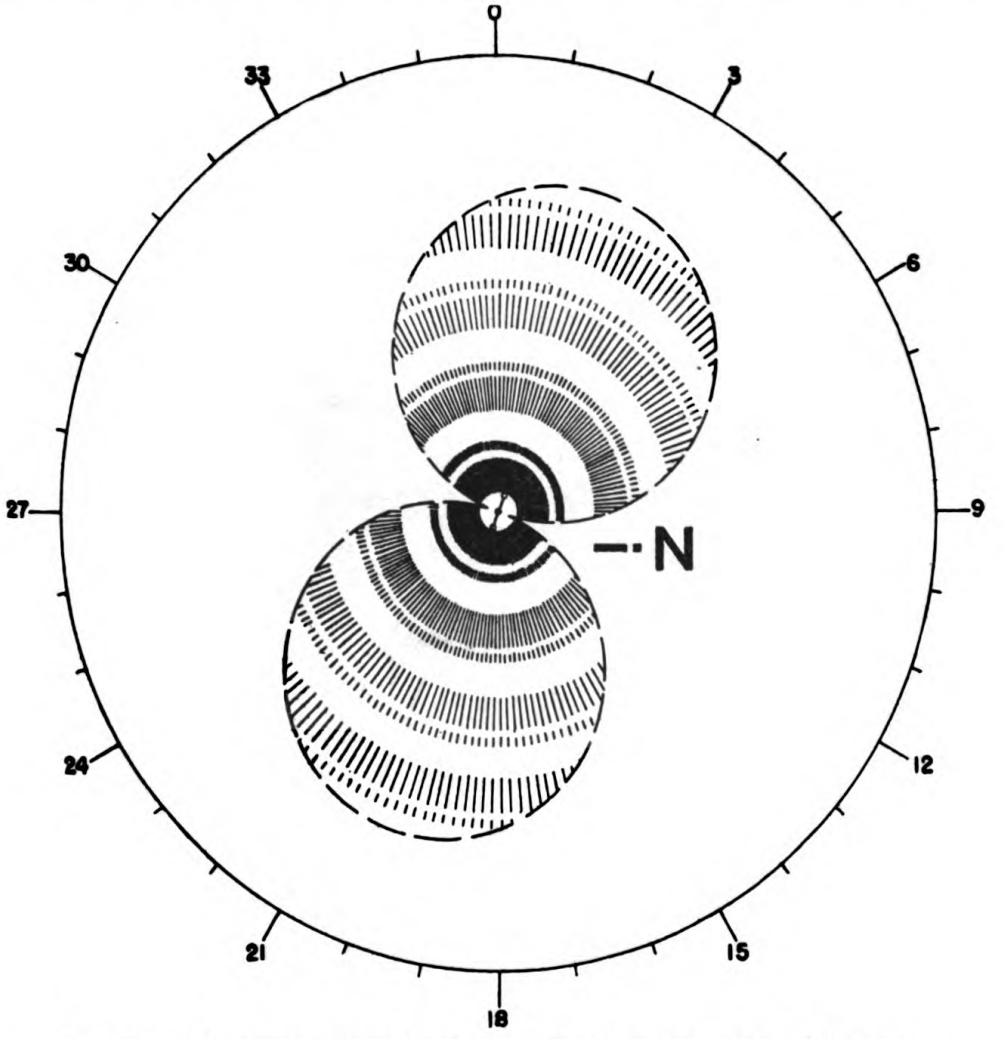


FIGURE 3.—Field strength pattern of opposite pair of towers into which letter "N" is keyed.

the pilot as the true on course signal. They usually exist within plus or minus 5 degrees of the true courses. At stations where multiple courses exist, airmen are warned in notices of their existence and they then use the range station accordingly.

79. Radio range and flight radio operator.—A radio operator in flight will have occasion to communicate frequently with radio range stations. The operator's transmissions will be made on the

laison transmitter. For receiving the range stations it will be necessary to use the compass receiver because the liaison receivers do not cover the frequency band to which radio range stations are assigned. Communication with range stations is at the pilot's discretion. The pilot may wish to contact the stations himself. On the other hand if the pilot desires it, he will turn the compass receiver over to the radio operator and advise the operator to contact the range station

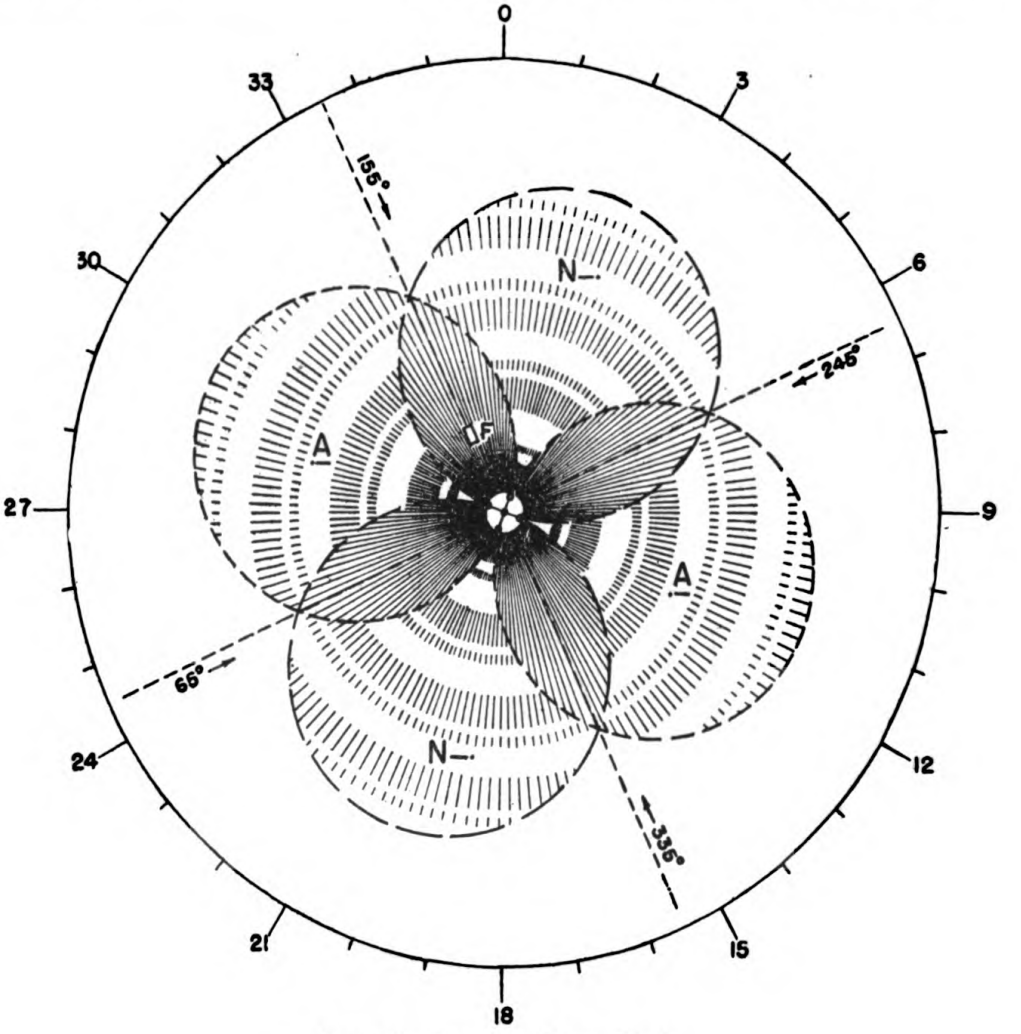


FIGURE 4.—Loops A and N combined.

or stations. The radio operator's duties will then be to transmit to the range station the position report, receive weather reports at stations over which passing, and receive traffic and other information. The procedure for communicating with radio range stations is prescribed in section VIII. Contacts will be businesslike and concise. The CAA personnel judge the Air Corps by the method in which communication contacts are handled by Air Corps personnel.

80. Cone of silence marker.—A characteristic of a radio range is the cone of silence, a zone of zero field intensity directly above the range station caused by cancelation of the radiated field at this point. It is very useful to the pilot in determining when he has passed the radio range station. (See fig. 6.) The zone of zero field inten-

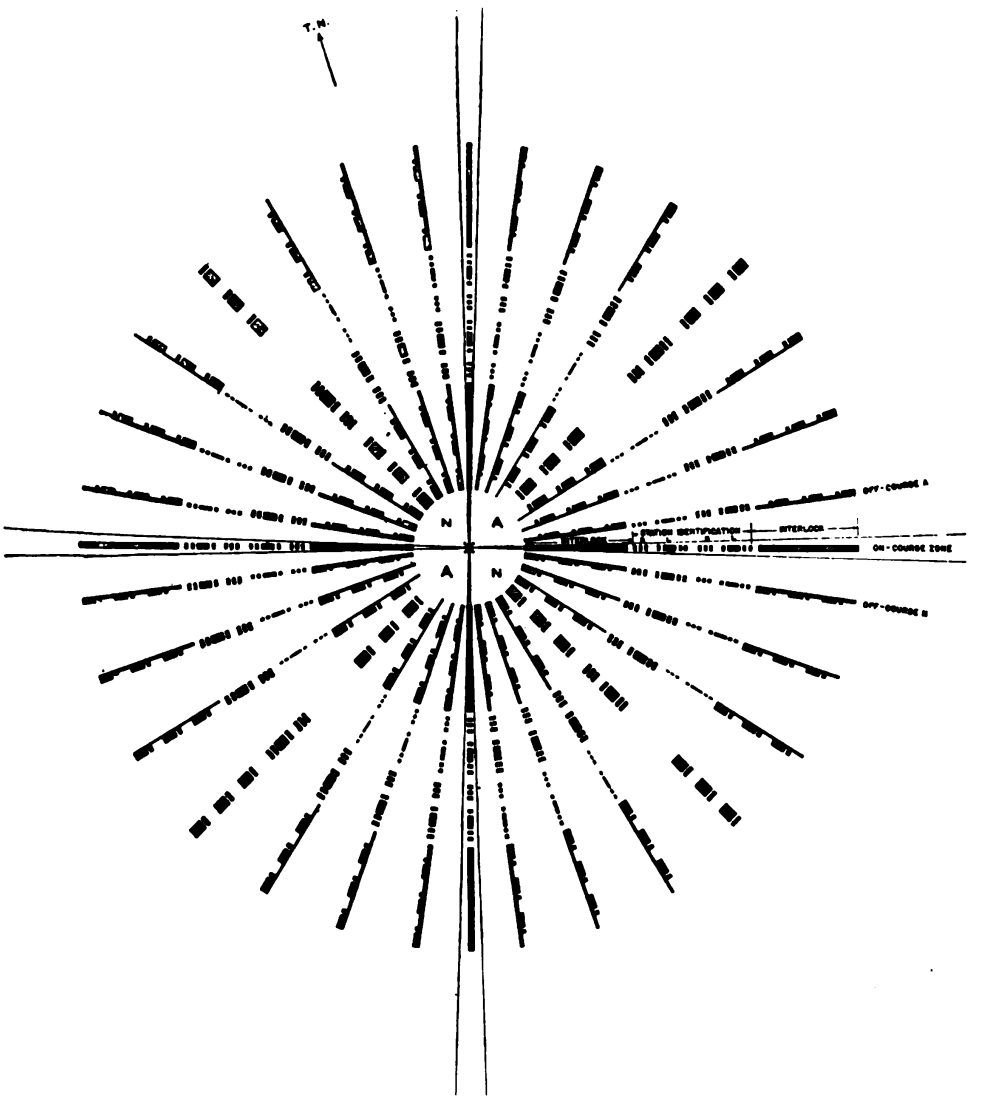


FIGURE 5.

sity is proportional to the altitude, taking the form of an inverted cone. This cone of silence is so useful to pilots as an aid in orienting their position preparatory to landing that a definite and wider marker was necessary. Thus the cone of silence marker came into being. This consists of an ultrahigh frequency transmitter (75 megacycles) located near the center tower of a range station. The antenna is

arranged so that the field strength pattern of the radiated signal is cone-shaped, the apex of the cone resting on the antenna. This signal is modulated with a 3,000-cycle tone and is continuous. The radiated signal fills the void over the range station and definitely

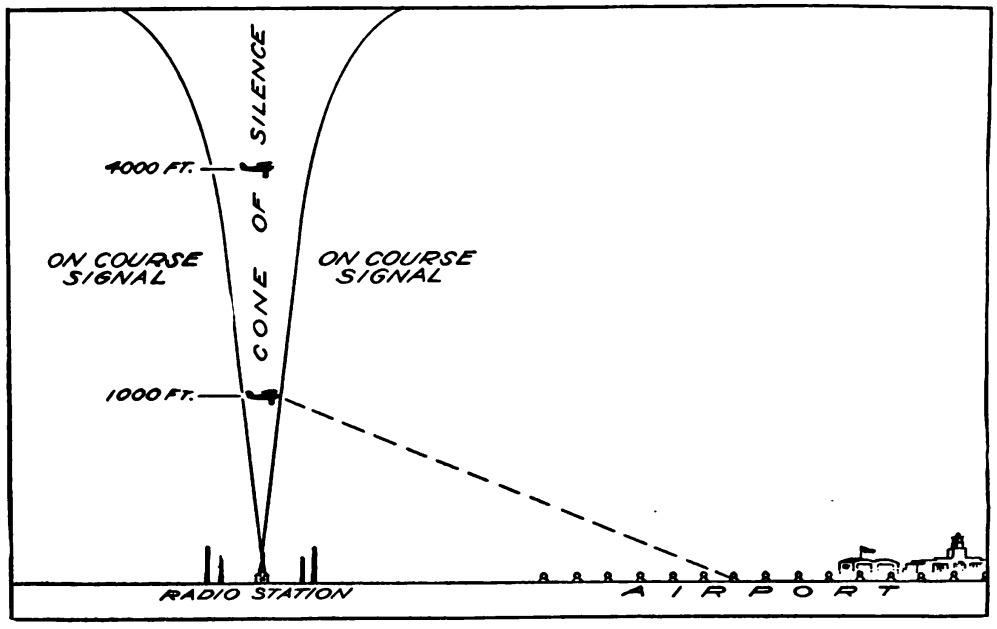


FIGURE 6.

indicates to the pilot his exact position. To receive this signal it is of course necessary that the aircraft be equipped with a 75-megacycle receiver.

SECTION VIII

PROCEDURE FOR COMMUNICATING WITH CIVIL AERONAUTICS ADMINISTRATION RANGE STATIONS

81. General.—Pilots or radio operators will contact Civil Aeronautics Administration radio range stations for the purpose of reporting their position, requesting weather and traffic information, filing flight plans, or making changes in flight plans.

82. Position report.—Position reports will be made to range stations in the following sequence:

a. Ship's call.
b. Name of pilot.
c. Position.
d. Time over reported position.
e. Altitude.
f. Flight conditions.

83. Example of position report.

Ship: "Denver radio from Army eight five zero six, answer."
Denver: "Army eight five zero six from Denver radio, go ahead."
Ship: "Army eight five zero six, pilot Case, two five east of Denver, one two five zero central standard, at eight thousand, on instruments. Estimating Denver at one three zero zero central standard, go ahead."
Denver: "Army eight five zero six, pilot Case, I will repeat your position, two five east of Denver, one two five zero central standard, at eight thousand, on instruments. Estimating Denver at one three zero zero central standard, go ahead."
Ship: "Denver radio from Army eight five zero six, that is correct."

84. Contact flight plan.—Civil air regulations state that a flight plan need not be filed for a contact flight. The Civil Aeronautics Administration stations will, however, accept a contact flight plan if the pilot desires to file a contact flight plan. No communications contacts with CAA stations are necessary on a contact flight. Position reports may be made, however, even though a flight plan has not been filed. The CAA radio operator will ask the ship if flight plan has been filed. If one has been filed, the CAA radio operator will forward the ship's progress report. If no flight plan has been filed, the CAA radio operator will enter the contact in his station log without further action.

85. Instrument flight plan.—Upon departure on a flight where instrument weather conditions will prevail, it is necessary to file a flight plan with the appropriate CAA communication station. If the Air Corps field is connected by teletype to a CAA circuit, the flight plan will be filed at the station on the field. If there is no teletype station on the field, the ship will depart and contact the nearest communication station and file a flight plan. The following information will be furnished the communication station in the sequence listed.

This sequence will not be altered. The ground operator will copy the flight plan on a blank made for the purpose.

Sequence	*Example*
Ship's call	8506
Type of ship	Army C–39
Pilot's name	Allee
Point of departure	Chanute Field
Altitude	4,000 (give approximate altitude)
Destination	Chanute Field
Route	Via (give route)
Air speed	180
Transmitting frequency	4495
Time of departure	1042CS
Estimated elapsed time	3 hours 10 minutes
Alternate airport	(give appropriate airport)
Remarks	Circle flight

NOTE.—A contact flight plan is similar in all respects to an instrument flight plan except that in a contact flight plan it is not necessary to include the alternate airport.

86. Communication contacts.—On an instrument flight, a continuous listening watch will be maintained on the appropriate radio frequency. The pilot or radio operator will contact and report as soon as possible to the appropriate communication station the time and altitude of passing each radio fix or other check point designated by the Secretary of Commerce or specified in the flight plan, together with unanticipated weather conditions being encountered and any other information pertinent to the aircraft movement. If not within an airway traffic control area, the pilot or radio operator will, prior to entering a control zone of intersection served by a CAA radio voice communication station, establish communication with such station, directly or through other communication channels, forwarding the expected time of arrival over the center of such zone, the altitude to be flown through such zone, and the course or courses proposed to be followed while within such zone.

87. Example of contact with control zone of intersection station.

Ship: "Columbus radio from Army eight five zero six, answer."
Columbus: "Army eight five zero six from Columbus radio, go ahead."
Ship: "Army eight five zero six, pilot Mundell, over the Brighton fan marker, one four one five eastern standard, at three thousand, on instruments. Estimating Columbus one four two five eastern standard at three thousand. After passing

Columbus will continue on east leg of Columbus range to Cambridge, go ahead."

Columbus: (Columbus will repeat entire text of position report.)

Ship: "Columbus radio from Army eight five zero six, that is correct."

88. Summary.—*a.* Whether a radio operator will or will not contact communications stations is at the discretion of the pilot. If the pilot assigns communication duties, the radio operator must be prepared for the task and must know what to do. Common sense in most cases will solve difficulties.

b. Requests for weather information will be made after the ground station has the position report.

c. The receipt of a traffic clearance into a control zone is normally the pilot's duty. The radio operator may be called on, however, to copy verbatim the clearance to be given to the pilot. The first rule of communication must be remembered: Never acknowledge or "okay" for anything unless the message has been received and there is no doubt about its accuracy. A traffic control clearance contains vital information. The radio operator's life may depend on the accuracy with which this information is received.

d. Ability to copy accurately all weather reports cannot be overemphasized. The information received will guide the pilot in making his flight under instrument conditions.

SECTION IX

FREQUENCIES

89. General.—The frequencies listed in paragraphs 90 to 98, inclusive, are important insofar as Air Corps radio operating is concerned. They are transmitting frequencies and should be memorized thoroughly.

90. Civil control tower.—278 kilocycles is assigned as the civil control tower frequency. Nearly all civil control towers operate on

this frequency. The only exception is where a congestion of airports exists, such as in the vicinity of New York City. In congested areas other frequencies are assigned to minimize interference.

91. Army control tower.—The Army control towers operate on several frequencies which are listed in the Air Corps Radio Facility Charts.

92. Army air-ground.—4,495 kilocycles is the assigned frequency to be used by Army aircraft. This frequency is strictly an Air Corps frequency and it is not used by other services.

93. National airways.—3,105 kilocycles is the assigned frequency for all itinerant and commercial aircraft. This frequency is occasionally used by the Government services insofar as aircraft are concerned. 6,210 kilocycles is a multiple of 3,105 kilocycles and is authorized for use by nearly all aircraft. This frequency, however, is very seldom used.

94. Radio range.—200 to 400 kilocycles is the band of frequencies assigned to this service.

95. Distress over ocean.—500 kilocycles is assigned as the international distress frequency over the ocean.

96. Distress over Great Lakes.—410 kilocycles is assigned as the distress frequency over the Great Lakes.

97. Direction finders.—375 kilocycles is assigned as the direction finding frequency.

98. Army airways.—4,220 kilocycles is assigned as the Army airways frequency.

99. Guarding a frequency.—Guarding a frequency means simply to listen continuously to a radio receiver which is tuned to the frequency being guarded. Other names for guarding a frequency would be: Standing a continuous watch, maintaining a continuous watch, standing by on a certain frequency. Listening frequencies should not be confused with transmitting frequencies. A station's frequency is the frequency on which that station will *transmit*.

SECTION X

FACILITY CHARTS

100. General.—As a visible representation of charted airways, radio facility charts are employed to aid in safety of travel. Each

chart covers a specific section of the country, comprising several States. All the radio ranges in these areas have been previously plotted and in most cases checked from the air as well as from the ground. Air Corps Radio Facility Charts and Air Corps Aids to Airway Flying are reproduced as Handbooks of Instruction, Air Corps Technical Order No. 08–15–1 and 08–15–2, for the convenience of Air Corps personnel. T. O. No. 08–15–1 contains the radio facility charts and related data; it is revised monthly. T. O. No. 08–15–2 contains information on airway traffic control areas, civil airways charts, list of broadcasting stations on the entertainment band, and other information not subject to frequent revision.

101. Weather broadcast schedules.—The weather broadcasting schedules of range stations have been placed in the charts on the pages opposite the map section to which they pertain. Due to limited space available, call letters, voice frequencies, elevation of field, etc., of ranges which do not have regular scheduled broadcasts have been tabulated separately on pages immediately following the maps. Nonscheduled or emergency broadcasts on radio ranges are preceded by an attention signal consisting of a series of dots (about 10 or 12) which are transmitted for a period of approximately one second.

102. Number and location of copies.—Copies of T. O. 08–15–1 and 08–15–2 will be furnished to Air Corps stations in numbers sufficient to provide one copy per pilot and one copy per co-pilot of radio equipped aircraft, and one copy per aircraft radio operator.

103. Identification.—Air Corps Radio Facility Charts will be identified at each station to which issued by placing in the space provided on the front cover the type and call letters of the aircraft to which assigned. In the case of copies provided for the use of radio operators, the unit designation will be placed in this space.

104. Inspection.—Commanding officers of Air Corps stations will cause station technical inspectors to make inspections that will insure that the charts are being corrected as changes are received. The individual making the inspection will enter on the record sheet under the column "Inspected by" the date and his initials.

105. Record of corrections.—A record of correction form has been included on the inside of the front cover of T. O. No. 08–15–1. The charts will be checked before being placed in service for changes which may have occurred after the date of printing. A record of correction will be maintained on this form and all corrections entered and initialed by the individual concerned.

106. Correcting facility charts.—Corrections on facility charts are made in pencil on the face of the map and on the page preceding the map, using the information contained in the section of the Weekly

Notice to Airmen, entitled "Communication and Weather Reporting Service." Pencil should be used because in most cases the changes in the charts are temporary, and their erasure is essential upon the rescission of the change. In this way, the chart can be maintained neatly and space will always be available for other remarks.

SECTION XI

TABLE NETS

107. General.—After the lecture and classroom discussion on radiotelephone procedure, the class will be divided into groups or nets. Operators will be assigned stations. Each man will act as either the pilot, control tower operator, Army airways operator, or radio range station operator. For practice purposes, the man chosen to act as the pilot will first contact the control tower for take-off instructions; next he will contact the Army airways communication station and give position report and make schedule for some later time; and then contact the range stations giving position reports and requesting weather and traffic information at stations ahead. The procedure as outlined in the manual will be observed. A business-like attitude in all contacts is advised. The operator must make sure that he knows what he is going to say before beginning; there should be no hesitation in giving reports. If for some reason continuity cannot be maintained, the station being communicated with should be advised to wait. After consolidating the information which is to be transmitted, communication should be continued. Whether a call-up will again be necessary depends upon the length of time off the air. Good judgment here will be the deciding factor.

108. Proficiency in nets.—All stations will maintain a continuous watch during the class period. In order that industrious students as well as the less apt ones may be given proper rating for proficiency in table nets, the following system will be used for grading students: There will, of course, be only two stations in communication with each other at one time. It is up to the other stations listening in to watch for errors in procedure, weather reports, position reports, or any other errors which another station might make. The student discovering the error will notify the net supervisor by raising his hand. The one finding the error will be asked to point out the error and give a correct

version of what was to be done. If the student has in fact found an error and given a correct version he will be given a proper credit and the one making the error will be given demerit. To prevent some students from becoming overzealous, they must in fact have found an error otherwise they will be given a demerit. If a few demerits are received they should occasion no alarm. An opportunity will come to point out errors of other operators. Each credit earned will cancel a demerit received. Corrections by other students should not be resented; they are for the benefit of all operators listening in. Any sign of resentment will severely affect the grade in proficiency. All weather reports will be intercepted and copied by all students.

109. Operation.—Operation in the table nets will be assumed to be the same as though one were actually in flight. If what was transmitted is not understood, repetition should be requested over the microphone, not across the table, since actual flight is being simulated.

110. Profanity.—Profanity and obscene language will not be tolerated. Making obscene remarks over the air is a court-martial offense. If it cannot be done over the air, there is no reason for doing it in the table nets. Grades will be assigned in accordance with what is done and how it is done.

111. Practical weather test.—Near the end of the radiotelephone procedure phase, a practical test will be given to ascertain ability to copy weather reports. By this time ability to transmit and copy such reports using standard symbols should be fairly well developed. Papers will be graded and the grade received on weather reports will be averaged with the grade made on table net operation and written examination.

SECTION XII

EMERGENCY PROCEDURE

112. Establishing contact.—Normally, calls to aircraft will be restricted to two attempts to establish contact with an interval of 15 seconds between calls. If contact is not established, a third call will be made, after an additional 15-second interval, the communication then being transmitted as a blind broadcast and terminated by a request for acknowledgment. If no acknowledgment is received, the three calls, followed by the blind broadcast, will be repeated at intervals of not less than 3 nor more than 5 minutes until the emergency communication has been transmitted three times.

113. Scheduled contacts.—When an aeronautical station does not receive an answer from an aircraft station at time of scheduled

contact, it will repeat the call at 15-second intervals during time allotted to contact (1 minute). If operator is unable to establish contact with the aircraft station, he will make use of all available facilities, including Civil Aeronautics Administration, to get information to pilot or to reestablish contact.

Appendix I

SYMBOLS OF A WEATHER REPORT

1. Weather element symbols.

Symbol	Meaning	Symbol	Meaning
R−_____	Light rain.	AP−____	Light small hail.
R−_____	Moderate rain.	AP_____	Moderate small hail.
R+_____	Heavy rain.	AP+____	Heavy small hail.
S−_____	Light snow.	P−_____	Light snow pellets.
S_____	Moderate snow.	P_____	Moderate snow pellets.
S+_____	Heavy snow.	P+_____	Heavy snow pellets.
ZR−____	Light freezing rain.	T−_____	Mild thunderstorm.
ZR_____	Moderate freezing rain.	T_____	Moderate thunderstorm.
ZR+____	Heavy freezing rain.	T+_____	Severe thunderstorm.
L−_____	Light drizzle.	SQ−____	Mild snow squall.
L_____	Moderate drizzle.	SQ_____	Moderate snow squall.
L+_____	Heavy drizzle.	SQ+____	Severe snow squall.
ZL−____	Light freezing drizzle.	RQ−____	Mild rain squall.
ZL_____	Moderate freezing drizzle.	RQ_____	Moderate rain squall.
ZL+____	Heavy freezing drizzle.	RQ+____	Severe rain squall.
E−_____	Light sleet.	SW−____	Light snow showers.
E_____	Moderate sleet.	SW_____	Moderate snow showers.
E+_____	Heavy sleet.	SW+____	Heavy snow showers.
A−_____	Light hail.	RW−___	Light rain showers.
A_____	Moderate hail.	RW_____	Moderate rain showers.
A+_____	Heavy hail.	RW+___	Heavy rain showers.

Note.—The word "tornado" is always written out in full.

2. Obstruction to vision symbols.

Symbol	Meaning	Symbol	Meaning
F−−____	Damp haze.	BS−____	Light blowing snow.
F−_____	Light fog.	BS_____	Moderate blowing snow.
F_____	Moderate fog.	BS+____	Thick blowing snow.
F+_____	Thick fog.	GS−____	Light drifting snow.
FF_____	Dense fog.	GS_____	Moderate drifting snow.
GF−____	Light ground fog.	GS+____	Thick drifting snow.
GF_____	Moderate ground fog.	BD−____	Light blowing dust.
GF+____	Thick ground fog.	BD_____	Moderate blowing dust.
GFF____	Dense ground fog.	BD+____	Thick blowing dust.
H_____	Hazy (dry haze).	BN−____	Light blowing sand.
K−_____	Light smoke.	BN_____	Moderate blowing sand.
K_____	Moderate smoke.	BN+____	Thick blowing sand.
K+_____	Thick smoke.	IF−_____	Light ice fog.
D−_____	Light dust.	IF_____	Moderate ice fog.
D_____	Moderate dust.	IF+_____	Thick ice fog.
D+_____	Thick dust.	IFF_____	Dense ice fog.

Appendix II

CHART OF WIND DIRECTIONS

↓	NORTH.
↓↙	NORTHNORTHEAST.
↙	NORTHEAST.
←↙	EASTNORTHEAST.
←	EAST.
←↖	EASTSOUTHEAST.
↖	SOUTHEAST.
↑↖	SOUTHSOUTHEAST.
↑	SOUTH.
↑↗	SOUTHSOUTHWEST.
↗	SOUTHWEST.
→↗	WESTSOUTHWEST.
→	WEST.
→↘	WESTNORTHWEST.
↘	NORTHWEST.
↓↘	NORTHNORTHWEST.

APPENDIX III

TABLE OF WIND VELOCITY EQUIVALENTS

Descriptive word	Velocity (m. p. h.)	Specifications
Calm	Less than 1	Smoke rises vertically.
	1 to 3	Direction of wind shown by smoke drift but not by wind vanes.
Light	4 to 7	Wind felt on face; leaves rustle; ordinary vane moved by wind.
Gentle	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
Moderate	13 to 18	Raises dust and loose paper; small branches are moved.
Fresh	19 to 24	Small trees in leaf begin to sway; crested wavelets form on inland waters.
	25 to 31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
Strong	32 to 38	Whole trees in motion; inconvenience felt in walking against the wind.
	39 to 46	Breaks twigs off trees; generally impedes progress.
Gale	47 to 54	Slight structural damage occurs (chimney pots and slates removed).
	55 to 63	Trees uprooted; considerable structural damage occurs.
Whole gale	64 to 75	Rarely experienced; accompanied by widespread damage.
Hurricane	Above 75	

NOTE—With the exception of "calm" these terms are not to be used in reporting velocity of wind.

Appendix IV

SKY SYMBOLS

A few sky (cloud) symbols found in weather reports are listed below. It is not possible to list all the combinations that can be made. The study of these symbols will give one an idea of their composition and method of reporting.

−⊕/◐	HIGH THIN OVERCAST LOWER BROKEN CLOUDS.
◑25◑	SCATTERED LOWER SCATTERED CLOUDS AT TWO THOUSAND FIVE HUNDRED FEET.
−◐/15+◑	HIGH THIN BROKEN LOWER DARK SCATTERED CLOUDS AT ONE THOUSAND FIVE HUNDRED FEET.
40◑	SCATTERED CLOUDS AT FOUR THOUSAND FEET.
+⊕	DARK OVERCAST.
−◑/20+◑	HIGH THIN SCATTERED LOWER DARK SCATTERED CLOUDS AT TWO THOUSAND FEET.
◑/◐	HIGH SCATTERED LOWER BROKEN CLOUDS.
⊕2◑	OVERCAST LOWER SCATTERED CLOUDS AT TWO HUNDRED FEET.
+⊕1◑	DARK OVERCAST LOWER SCATTERED CLOUDS AT ONE HUNDRED FEET.
⊕+◐	OVERCAST LOWER DARK BROKEN CLOUDS.
◐◐	BROKEN LOWER BROKEN CLOUDS.
⊕◐	OVERCAST LOWER BROKEN CLOUDS.
⊕/25◑	HIGH OVERCAST LOWER SCATTERED CLOUDS AT TWO THOUSAND FIVE HUNDRED FEET.
−◑/◐	HIGH THIN SCATTERED LOWER BROKEN CLOUDS.
+◑	DARK SCATTERED CLOUDS.
+◐	DARK BROKEN CLOUDS.
−◑	THIN SCATTERED CLOUDS.
◐/◐	HIGH BROKEN LOWER BROKEN CLOUDS.

Appendix V

SAMPLE TELETYPE WEATHER REPORTS

KC C E40⊕/◍6K— 190/61/51 ↑ ↗17+/008/FEW CLDS 20 HND
LW 21⊕ 183/60/51↗12/006
MH —⊕/50Ⓘ 196/64/48 ↑ ↗23—/011
CA E 60—⊕/◍ 210/61/45 ↑ ↗20—/013
NF E60⊕/◍ 62/43 ↑ 12
LS C E60—⊕/◍5K— 237/58/40 ↑ 16/022
CD —⊕/80Ⓘ 257/56/34 ↑ 13/047
EF ⊕/40Ⓘ8 264/55/34 ↑ ↗9/030
NU ⊕/ 244/50/32 ↑ 16/032/THN SPOTS
TH —⊕/7 274/52/31 ↑ ↗14/032
ID C ⊕/8 284/54/30 ↑ 7/034
MV —◍/5H 55/28 ↑ ↗14
RM —◍/8 295/54/20↗17/037
DY C —Ⓘ/5K— 301/51/31↗16/039
CO C —◍/6K— 312/51/33↗↗13/043
HA —◍/4H 312/50/32 ↑ ↗14/041
CV C —◍/5K— 301/51/33↗15/039
AX C —Ⓘ/4K— 315/48/30↗15/043
CM —◍/6K—322/53/34↗8/045
EZ SPL —◍/11/4K— 322/47/33 ↑ 9/044
PT N —Ⓘ/11/2K— 325/51/29 ↑ ↗11/045
BQ O7 362/42/28 ↑ 10/050
RF O8 356/43/31 ↑ 7/053

Appendix VI

PHRASEOLOGY FOR STATING NUMBERS

1. Time.

AM	PM	Statement
12:01	----------	Zero zero zero one.
12:25	----------	Zero zero two five.
6:00	----------	Zero six zero zero.
----------	12:20	One two two zero.
----------	3:02	One five zero two.
----------	6:00	One eight zero zero.
----------	9:20	Two one two zero.
----------	11:50	Two three five zero.
----------	12:00	Zero zero zero zero.

2. Ceiling.

Feet	Statement
700	Seven hundred feet.
1, 000	One thousand feet.
1, 200	One thousand two hundred feet.
1, 500	One thousand five hundred feet.
2, 000	Two thousand feet.
2, 400	Two thousand four hundred feet.
2, 700	Two thousand seven hundred feet.
3, 300	Three thousand three hundred feet.
4, 600	Four thousand six hundred feet.

3. Altitude of field.

Feet	Statement
10	Field elevation one zero.
75	Field elevation seven five.
583	Field elevation five eight three.
600	Field elevation six hundred.
744	Field elevation seven four four.
1, 850	Field elevation one eight five zero.
2, 749	Field elevation two seven four nine.
6, 382	Field elevation six three eight two.

PHRASEOLOGY FOR STATING NUMBERS—Continued

4. Altimeter setting.

Setting	Statement
28:00	Two eight zero zero.
28:03	Two eight zero three.
29:09	Two nine zero nine.
29:54	Two nine five four.
30:96	Three zero nine six.

5. Altitude in position reports.

Feet	Statement
2, 000	Two thousand.
3, 000	Three thousand.
4, 000	Four thousand.
5, 000	Five thousand.
6, 000	Six thousand.
10, 000	Ten thousand, one zero thousand.
11, 000	Eleven thousand, one one thousand.
12, 000	Twelve thousand, one two thousand.

Appendix VII

STANDARD LIGHT SIGNALS—CONTROL TOWER

1. The following light signals are prescribed:

a. While an airplane is in flight:

Green light	Cleared to land.
Red light	Do not land. Stay clear of field and continue circling.

b. While an airplane is taxiing:

Green light	Continue taxiing.
Flashing red light	Return to hangar line.
Red light	Stop immediately.

c. While airplane is in take-off position:

Green light	Clear to take off.
Flashing red light	Return to hangar line.
Red light	Do not take off, wait.

2. If a pilot desires to land at night, he will turn on his landing lights. The tower will acknowledge this signal by use of light signals as outlined in paragraph 1. A series of flashes of the landing lights will indicate that—

a. If the floodlight is on, the pilot wants it turned off.

b. If the floodlight is off, the pilot wants it turned on.

Appendix VIII

ABBREVIATIONS AND PHRASE CONTRACTIONS

Abbreviation and contraction	Meaning
ABNDC	abundance
ABNDT	abundant
ABNML	abnormal
ABRD	aboard
ABSD	absorb
ABT	about
ABV	above
AC	altocumulus
ACC	altocumulus castellatvs
ACCT	account
ACELT	accelerate
ACFT	aircraft
ACK	acknowledge
ACMLT	accumulate
ACPT	accept
ACPY	accompany
ACRS	across
ACTG	acting
ACTN	action
ACTV	active
ADJN	adjoin
ADJT	adjacent
ADN	addition
ADQT	adequate
ADRNDCK	Adirondack
ADS	address
ADVC	advice
ADVN	advance
ADVR	adverse
ADVZ	advise
ADVZY	advisory
AERLGL	aerological
AERLY	aerology
AERNL	aeronautical
AFCT	affect
AFDK	after dark
AFP	alternate flight plan
AFT	after
AFTN	afternoon
AGN	again

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
AGRSV	aggressive
AHD	ahead
ALA	Alabama
ALF	aloft
ALG	along
ALGHNY	Alleghany
ALSK	Alaska
ALT	altitude
ALTA	Alberta
ALTF	alternate field
ALTN	alternate
ALUTN	Aleutian
AM	ante meridian
AMAFA	air mass and frontal analysis
AMGT	amalgamate
AMS	air mass
AMT	amount
ANCPT	anticipate
ANLGS	analogous
ANLYS	analysis
ANLZ	analyze
ANS	answer
ANT	antenna
ANTHR	another
APCH	approach
APLCHN	Appalachian
APOBS	airplane weather observations
APPR	appear
APRT	apparent
APRX	approximate
APV	approve
ARBTY	arbitrary
ARIZ	Arizona
ARK	Arkansas
ARND	around
ARNG	arrange
ARV	arrive
AS	altostratus
ASCD	ascend
ASCT	ascent
ASGN	assign
ASM	assume
ASMN	assumption
ASOCT	associate
ASSAP	as soon as practicable
ATC	airway traffic control
ATCH	attach
ATLC	Atlantic

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
ATND	attend
ATSPH	atmosphere
ATT	American Telephone & Telegraph Company
AUG	August
AUGRA	authority granted
AURBO	aurora borealis
AUTO	automatic
AUX	auxiliary
AUZRE	authority is requested
AVE	average
AVL	avail
AWEA	account weather
AWO	airways weather office
AWY	airway
BAG	baggage
BAL	Bowen Airlines
BC	British Columbia
BCFT	Beechcraft
BCM	become
BCN	beacon
BDC	broadcast
BDR	border
BEBNR	beacon light burning but not revolving
BENBU	beacon light not burning
BFR	before
BGN	begin
BL	bill of lading
BLC	balance
BLD	build
BLK	black
BLKT	blanket
BLP	bomber landplane
BLST	ballast
BLW	blow
BME	Boston-Maine Airways
BND	bound
BNDRY	boundary
BNF	Braniff Airways
BNTH	beneath
BOIG	Boeing
BRD	board
BRGT	bright
BRK	break
BRKN	broken
BRKSHR	Berkshire
BRM	barometer
BRMC	barometric
BRONO	broadcast not operating

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
BROOK	broadcast resumed operation
BSP	bomber seaplane
BTR	better
BTWN	between
BULET	bureau letter
BYD	beyond
CAA	Civil Aeronautics Administration
CAL	Columbia Airlines
CALIF	California
CAN	Canada
CAP	cleared as planned
CAPT	captain
CASCDS	Cascades
CAVU	ceiling and visibility unrestricted
CB	cumulonimbus
CC	cirrocumulus
CFM	confirm
CFN	confine
CHG	change
CHSPK	Chesapeake
CHTR	charter
CI	cirrus
CIG	ceiling
CIR	circular
CK	check
CKT	circuit
CLB	climb
CLD	cloud
CLR	clear
CLZ	close
CM	cumulonimbus mammatus (mammatocumulus)
CMNC	commence
CMPS	compass
CMPT	compartment
CMRC	commerce
CNA	Canadian Airways
CNCL	cancel
CND	condition
CNDN	Canadian
CNT	connect
CNTR	center
CNTRL	central
CO	commanding officer
CO	company
COL	colonel
COLO	Colorado
COMDR	commander
COMDT	commandant

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
COMP	complete
CONN	Connecticut
CONST	construct
CONT	continue
COREQ	confirming requisition follows
CONTDVD	Continental Divide
CPTY	capacity
CPZ	compose
CQN	correction
CQT	correct
CRC	circle
CRS	course
CRZ	cruise
CS	central standard (time)
CS	cirrostratus
CSA	Chicago & Southern Airways
CSDR	consider
CST	coast
CTC	contact
CTL	control
CTN	caution
CTSKLS	Catskills
CU	cumulus
CVA	Central Vermont Airways
CVR	cover
CYL	cylinder
DABRK	daybreak
DAL	Delta Airlines
DALGT	daylight
DBL	double
DBT	doubt
DBTF	doubtful
DC	District of Columbia
DCLN	decline
DCRS	decrease
DEC	December
DEL	Delaware
FANOT	fan type marker inoperative
FAROK	fan type marker resumed normal operation
FC	fractocumulus
FCLD	Fairchild
FCST	forecast
FCTY	factory
FEB	February
FED	Federal
FELT	familiarization flight
FILLI	field and lighting facilities
FINAC	field notice to airmen is current

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
FLA	Florida
FLC	falling
FLD	field
FLP	fighter landplane
FLRY	flurry
FLT	flight
FLW	follow
FORNN	forenoon
FPLN	flight plan
FPM	feet per minute
FQCY	frequency
FQT	frequent
FRI	Friday
FRM	form
FRSH	fresh
FRST	frost
FRZ	freeze
FRZN	frozen
FS	fractostratus
FSP	fighter seaplane
FT	feet; foot; fort
FTHR	farther; further
FTNX	full tanks
FVR	favor
FWD	forward
GA	Georgia
GAL	gallon
GAS	gasoline
GAT	Gorst Air Transport
GBA	give better address
GND	ground
GNDFG	ground fog
GNRL	general
GOVT	Government
GRDL	gradual
GRT	great
GST	gust
HD	head
HDQRTRS	headquarters
HDWND	headwind
HI	high
HIWA	highway
HLD	hold
HLF	half
HMD	humid
HND	hundred
HNG	hang
HR	hour

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
HRZN	horizon
HURCN	hurricane
HVY	heavy
HYDRO	hydrographic
HZY	hazy
MD	Maryland
MDT	moderate
ME	Maine
METGL	meteorological
MICH	Michigan
MID	middle
MIDN	midnight
MIN	minute
MINN	Minnesota
MISG	missing
MISS	Mississippi
ML	mail
MLD	mild
MNTN	maintain
MO	Missouri
MON	Monday
MONT	Montana
MOV	move
MPH	miles per hour
MRKR	marker
MRNG	morning
MRTM	maritime
MS	mountain standard (time)
MSG	message
MSL	mean sea level
MST	most
MSTK	mistake
MSTR	moisture
MTN	mountain
MXD	mixed
NACOS	National Communication Schedule
NAV	navigation
NC	North Carolina
ND	North Dakota
NEB	Nebraska
NEC	necessary
NEV	Nevada
NGT	night
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NO	number
NOBND	northbound

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
NORDO	no radio
NOTAM	notice to airmen
NOV	November
NRML	normal
NS	nimbostratus
NVR	never
NXT	next
NY	New York
OBS	observe
OBSC	obscure
OBST	obstruct
OCLD	occlude
OCN	occasion
OCT	October
OHIO	Ohio
OKLA	Oklahoma
RAOBS	radiometrograph observations
RANOT	radio range not operating
RCH	reach
RCKY	rocky
RCMD	recommend
RCV	receive
RDG	ridge
RDO	radio
RE	reference
REG	register
REQ	request
RFL	refuel
RGD	ragged
RGLR	regular
RGLT	regulate
RGN	region
RGT	right
RI	Rhode Island
RLA	relay
RLS	release
RMD	remind
RMN	remain
RMRK	remark
RMV	remove
RNG	range
RNWY	runway
RPD	rapid
RPL	replace
RPRT	report
RPT	repeat
RQN	requisition
RQR	require

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
RR	railroad
RSG	rising
RSN	risen
RSV	reserve
RSVN	reservation
RTE	route
RTN	return
RUF	rough
RUTEL	reference telegram from your office
RVR	river
RYRQD	reply requested
SASK	Saskatchewan
SAT	Saturday
SBSD	subside
SC	South Carolina
SC	stratocumulus
SCT	scatter
SCTR	sector
SD	South Dakota
SEC	second
SEP	September
SEQ	sequence
SFC	surface
SFCT	sufficient
SGST	suggest
SGT	sergeant
SHFT	shift
SHLW	shallow
SHWR	shower
SIERNEV	Sierra Nevada
SIG	signature
SISKY	Siskiyou
SIT	situate
SKJ	schedule
SLGT	slight
SLP	scout landplane
SLT	sleet
SLW	slow
SMRY	summary
SMTM	sometime
SMWHT	somewhat
SNGL	single
SNW	snow
SOBND	southbound
SP	seaplane
SPEC	specification
SPKL	sprinkle
SPL	special

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
SPRD	spread
SPT	separate
SQAL	squall
SQDN	squadron
SRCH	search
SRND	surround
SRS	see our service
SSP	scout seaplane
ST	stratus; street; saint
STA	State
STG	strong
STI	settle
STM	stern
STN	station
STP	stop
STRSPH	stratosphere
STSN	Stinson
STWD	steward
SUN	Sunday
SUNRS	sunrise
SUNST	sunset
SUPR	superior
SUPT	superintendent
SUREQ	submit requisition
SVC	service
SVR	severe
SVRL	several
SXN	section
SYS	see your service
TDA	today
TELNO	telegraph (radio) communications interrupted
TELOK	telegraph (radio) communications resumed
TELRY	telegraph reply
TENN	Tennessee
TERM	terminate
TEX	Texas
TFK	traffic
THD	thunderhead
THDR	thunder
THK	thick
THN	thin
THRFTR	thereafter
THRU	through
THRUT	throughout
THSD	thousand
THTN	threaten
THU	Thursday
TKOF	take(ing) off

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
TKT	ticket
TLFO	telephone
TLP	transport landplane
TLTP	teletype
TMP	temperature
TMW	tomorrow
TNCY	tendency
TNGT	tonight
TNTV	tentative
TOVC	top of overcast
TPG	topping
TRML	terminal
TRPAT	Tropical Atlantic
TRPGU	Tropical Gulf
TRPMA	Tropical Maritime
TRPPA	Tropical Pacific
TRTY	territory
TSATLC	Trans-Atlantic
TSFR	transfer
TSFRM	transform
TSHER	thundershower
TSLPOL	Transitional Polar
TSLPOLAT	Transitional Polar Atlantic
TSLPOLCO	Transitional Polar Continental
TSLPOLPA	Transitional Polar Pacific
TSLTRPAT	Transitional Tropical Atlantic
TSLTRPGU	Transitional Tropical Gulf
TSLTRPMA	Transitional Tropical Maritime
TSLTRPPA	Transitional Tropical Pacific
TSMT	transmit
TSP	transport seaplane
TSPAC	Trans-Pacific
TSPT	transport
TSTM	thunderstorm
TUE	Tuesday
TURBO	turbulence
TURBT	turbulent
TWA	Transcontinental & Western Air, Inc.
TWD	toward
TWIZN	twilight zone
TYPNO	teletype communications interrupted
TYPOK	teletype communications resumed
UAL	United Airlines
ULP	utility landplane
UNAB	unable
UNEC	unnecessary
UNL	unlimited
UNR	unraise

ABBREVIATIONS AND PHRASE CONTRACTIONS—Continued

Abbreviation and contraction	Meaning
UNRD	unread
UNSTDY	unsteady
UNSTL	unsettle
UNUSL	unusual
UPWD	upward
UQOT	unquote
URNWY	use runway
US	United States
USP	utility seaplane
UTAH	Utah
VA	Virginia
VAT	Varney Air Transport
VCNTY	vicinity
VEGA	Vega
VEL	velocity
VFY	verify
VLNC	violence
VLNT	violent
VLY	valley
VPR	vapor
VRBL	variable
VRG	veering
VSB	visible
VSBY	visibility
VSN	vision
VT	Vermont
WACO	Waco
WASH	Washington
WAT	Watertown Airways
WBTS	whereabouts
WD	word
WEA	weather

APPENDIX IX

TELETYPE DESIGNATORS

Designator	Location	Designator	Location
AB_____	Albuquerque, N. Mex.	CN_____	Concord, N. H.
AF_____	Advance, Mo.	CO_____	Columbus, Ohio.
AG_____	Atlanta, Ga. (Candler Field)	CR_____	Corpus Christi, Tex.
AH_____	Alameda, Calif.	CS_____	Charleston, S. C.
AI_____	Agua Caliente, Mex.	CT_____	Castle Rock, Wash.
AJ_____	Alma, Ga.	CU_____	Custer, Mont.
AK_____	Acomita, N. Mex.	CV_____	Cleveland, Ohio.
AL_____	Arlington, Oreg.	CW_____	Casper, Wyo.
AM_____	Ann Arbor, Mich.	CX_____	Cassoday, Kans.
AP_____	Abilene, Tex.	CZ_____	Chanute, Kans.
AR_____	Auburn, Calif.	DB_____	Daytona Beach, Fla.
AS_____	Anderson, S. C.	DF_____	Dryden, Tex.
AT_____	Ardmore, Okla.	DG_____	Daggett, Calif.
AU_____	Appleton, Wis.	DH_____	Duluth, Minn.
AV_____	Adairsville, Ga.	DJ_____	Del Monte, Calif.
AW_____	Augusta, Maine.	DK_____	Dunkirk, N. Y.
AY_____	Anthony, Kans.	DL_____	Dallas, Tex.
AZ_____	Albany, N. Y.	DM_____	Des Moines, Iowa.
BA_____	Beowawe, Nev.	DO_____	Detroit, Mich., City Airport.
BD_____	Bangor, Maine.	DP_____	Du Pont Airport, Wilmington, Del.
BD_____	Bakersfield, Calif.		
BE_____	Boise, Idaho.	DT_____	Detroit, Mich., Wayne County Airport.
BF_____	Bellefonte, Pa.		
BG_____	Big Springs, Nebr.	DV_____	Denver, Colo.
BH_____	Birmingham, Ala.	DW_____	Dawson, N. Dak.
BI_____	Billings, Mont.	DX_____	Davenport, Iowa (Cram Field).
BJ_____	Buffalo, N. Y.		
BL_____	Belgrade, Mont.	DY_____	Vandalia, Ohio.
BO_____	Baltimore, Md.	DZ_____	DuBois, Idaho.
BQ_____	Buckstown, Pa.	EA_____	Elmira, N. Y.
BR_____	Brookville, Pa.	EF_____	Effingham, Ill.
BU_____	Burbank, Calif.	EG_____	Elgin, Ill.
BZ_____	Big Spring, Tex.	EK_____	Elkins, W. Va.
CA_____	Columbia, Mo.	EM_____	El Morro, N. Mex.
CB_____	Chattanooga, Tenn.	EO_____	El Paso, Tex.
CC_____	Cincinnati, Ohio.	ER_____	Erie, Pa.
CD_____	Scott Field, St. Louis, Mo.	EV_____	Evansville, Ind.
CG_____	Chicago, Ill.	EY_____	Elk City, Okla.
CJ_____	Chesterfield, Tenn.	EZ_____	East Liverpool, Ohio.
CM_____	Cambridge, Ohio.	FD_____	Frederick, Md.

TELETYPE DESIGNATORS—Continued

Designator	Location	Designator	Location
FF_____	Spring Bluff, Mo.	JI_____	Brownsville, Tex.
FG_____	Pittsfield, Mass.	JM_____	Jamestown, N. Dak.
FH_____	Red Bluff, Calif.	JN_____	Jackson, Mich.
FI_____	Fort Sill, Okla.	JO_____	Joliet, Ill.
FJ_____	Fort Jones, Calif.	JP_____	Joplin, Mo.
FK_____	Ashfork, Ariz.	JR_____	Baton Rouge, La.
FM_____	Fort Myers, Fla.	JS_____	Santa Ana, Calif.
FN_____	Flint, Mich.	JX_____	Jacksonville, Fla.
FO_____	Fargo, N. Dak. (Hector Field).	KC_____	Kansas City, Mo.
		KF_____	Kelly Field, Tex.
FP_____	Fort Plain, N. Y.	KG_____	Kingston, Calif.
FR_____	Fort Smith, Ark.	KL_____	Knoxville, Mo.
FS_____	Forsyth, Mont.	KM____	Camden, N. J.
FT_____	Fresno, Calif. (Chandler Field).	KN_____	Charleston, W. Va.
		KR_____	Kirksville, Mo.
FV_____	Fort Worth, Tex.	KV_____	Coffeyville, Kans.
FW_____	Fort Wayne, Ind.	KW____	Key West, Fla.
FX_____	Fontana, Calif.	KX_____	Knoxville, Tenn.
FY_____	Fort Riley, near Salina, Kans.	KZ_____	Kalamazoo, Mich.
		LA_____	Los Angeles, Calif.
FZ_____	Front Royal, Va.	LB_____	Lynchburg, Va.
GA_____	Golva, N. Dak.	LC_____	Lake Charles, La.
GE_____	Gainesville, Tex.	LD_____	Selfridge Field, Mich.
GF_____	Grand Forks, N. Dak.	LE_____	La Crosse, Wis.
GI_____	Grand Island, Nebr.	LF_____	Lafayette, Ind.
GJ_____	Gordonsville, Va.	LG_____	La Grande, Oreg.
GO_____	Goshen, Ind.	LI_____	Little Rock, Ark.
GP_____	Guadalupe Pass, Tex.	LJ_____	Lansing, Mich.
GR_____	Grand Rapids, Mich.	LK_____	Lone Rock, Wis.
GS_____	Galveston, Tex.	LM_____	Livermore, Calif.
GW____	Greensboro, N. C.	LN_____	Lebo, Kans.
HA_____	Hayesville, Ohio.	LP_____	Lakehurst, N. J.
HC_____	Hager City, Wis.	LQ_____	Las Vegas, Nev.
HF_____	Hatbox Field, Okla.	LR_____	Laramie, Wyo.
HO_____	Hamilton Field, Calif.	LS_____	St. Louis, Mo.
HT_____	Hartford, Conn.	LT_____	Livingston, Mont.
HU_____	Houston, Tex.	LV_____	Louisville, Ky.
HX_____	Harrisburg, Pa.	LY_____	Langley Field, Va.
HY_____	Hensley Field, Fort Worth, Tex.	MA_____	Madison, Wis.
		MD____	Milford, Utah
IB_____	Caribou, Maine.	MF_____	Medford, Oreg.
IC_____	Wenatchee, Wash.	MH____	Marshall, Mo.
ID_____	Indianapolis, Ind.	MK____	Milwaukee, Wis.
II_____	Roosevelt Field, N. Y.	MM____	Miami, Fla.
IN_____	Indio, Calif.	MO_____	Moline, Ill.
JA_____	Jackson, Miss.	MP_____	Minneapolis, Minn.
JG_____	Burlington, Vt.	MS_____	Mobile, Ala.
JH_____	Bar Harbor, Maine.	MV_____	Milroy, Ind.

TELETYPE DESIGNATORS—Continued

Designator	Location	Designator	Location
MZ_____	Montezuma, Iowa	SF_____	San Francisco, Calif.
NA_____	Nashville, Tenn.	SL_____	Salt Lake City, Utah.
NC_____	Pensacola, Fla.	SM_____	Spokane, Wash.
NF_____	New Florence, Mo.	SN_____	South Bend, Ind.
NK_____	Newark, N. J.	SO_____	Smiths Grove, Ky
NL_____	Nogales, Ariz.	SQ_____	San Diego, Calif.
NO_____	New Orleans, La.	SR_____	Syracuse, N. Y.
NQ_____	North Platte, Nebr.	SU_____	Spartanburg, S. C.
NR_____	Norfolk, Va.	SW_____	Moffett Field, Calif.
NT_____	Navasota, Tex.	SX_____	Salem, Oreg.
NU_____	Chanute Field, Ill.	SZ_____	Sacramento, Calif.
NX_____	New Hackensack, N. Y.	TA_____	Tacoma, Wash.
NZ_____	Mormon Mesa, Nev.	TC_____	Tucumcari, N. Mex.
OA_____	Oakland, Calif.	TD_____	Trinidad, Colo.
OC_____	Oceanside, Calif.	TF_____	Scotts Bluff, Nebr.
OD_____	Modesto, Calif.	TH_____	Terre Haute, Ind.
OH_____	Omaha, Nebr.	TJ_____	Tallahassee, Fla.
OL_____	Oklahoma City, Okla.	TK_____	Tarkio, Mo.
ON_____	Sloan Field, Tex.	TL_____	Toledo, Ohio.
OP_____	Pope Field, Ft. Bragg, N. C.	TM_____	Tampa, Fla.
OS_____	Oshkosh, Wis.	TN_____	Trenton, N. J.
OT_____	Otto, N. Mex.	TO_____	Topeka, Kans.
OX_____	Biloxi, Miss.	TR_____	Texarkana, Tex.
PB_____	Pembina, N. Dak.	TS_____	Tulsa, Okla.
PD_____	Portland, Oreg.	TU_____	Tuscaloosa, Ala.
PG_____	Philadelphia, Pa.	TV_____	Tyler, Tex.
PH_____	Phoenix, Ariz.	TW_____	Twin Falls, Idaho.
PI_____	Peoria, Ill.	TY_____	Tylertown, Miss.
PK_____	Patterson Field, Dayton, Ohio.	TZ_____	Tucson, Ariz.
		UA_____	Utica, N. Y.
PQ_____	Pocatello, Idaho.	UB_____	Alhambra, Calif.
PR_____	Providence, R. I.	UG_____	Montgomery. Ala.
PS_____	Memphis, Tenn.	UH_____	Plymouth, Utah.
PT_____	Pittsburgh, Pa.	UK_____	Muskegon, Mich.
PU_____	Pueblo, Colo.	UP_____	Palm Springs, Calif.
RA_____	Raleigh, N. C.	US_____	Pulaski, Va.
RC_____	Rochester, N. Y.	VD_____	Augusta, Ga.
RD_____	Rockford, Ill.	VG_____	Parkersburg, W. Va.
RK_____	Bismarck, N. Dak.	VH_____	Las Vegas, N. Mex.
RM____	Richmond, Ind.	VS_____	Vicksburg, Miss.
RN_____	Akron, Colo.	WA_____	Washington, D. C.
RO_____	Roanoke, Va.	WC_____	Waco, Tex.
RP_____	Reno, Nev.	WD____	Wichita, Kans.
RQ_____	Rock Island, Ill.	WM____	Mitchel Field, N. Y.
RV_____	Riverside, Calif.	WO_____	Winslow, Ariz.
RW____	Richmond, Va.	WP_____	Wink, Tex.
SA_____	Seattle, Wash.	WU____	Watertown, S. Dak.
SD_____	Sidney, Nebr.	WAB___	Aberdeen, Md.

TELETYPE DESIGNATORS—Continued

Designator	Location	Designator	Location
WBF___	Bolling Field, Washington, D. C.	XW____	Montgomery, Ala. (Maxwell Field).
WBL___	Fort Bliss, El Paso, Tex.	XBF____	Bolling Field, D. C.
WBR___	Brooks Field, San Antonio, Tex.	XCD___	Scott Field, St. Louis, Mo.
WCN___	Schoen Field, Ft. Benj. Harrison, Indianapolis, Ind.	XHO___	Hamilton Field, San Francisco, Calif.
WDF___	Duncan Field, San Antonio, Tex.	XLD___	Selfridge Field, Detroit, Mich.
WFC___	Fort Crockett, Galveston, Tex.	XLY___	Langley Field, Hampton, Va.
WFL___	Fort Lewis, Tacoma, Wash.	XMZ___	March Field, Riverside, Calif.
WKS___	Barksdale Field, Shreveport, La.	XNU___	Chanute Field, Rantoul, Ill.
WMT___	Middletown, Pa. (Olmstead Field).	XPK___	Patterson Field, Dayton, Ohio.
WMZ___	March Field, Calif.	XRD___	Fairfax Field, Kansas City, Kans.
WLY___	Lowry Field, Denver, Colo.	XSW___	Moffett Field, Sunnyvale. Calif.
WBG___	Biggs Field, El Paso, Tex.	XWM__	Mitchel Field, Long Island, N. Y.
WOF___	Offutt Field, Omaha, Nebr.	YA_____	Yakima, Wash.
WRA___	Randolph Field, San Antonio.	YC_____	Calgary, Alta.
WRD___	Fairfax Field, Kansas City, Kans.	YH_____	Blythe, Calif.
WSC___	McCellan Field, Calif.	YL_____	Sioux Falls, S. Dak.
WST___	Stout Field, Indianapolis, Ind.	ZD_____	Springfield, Ill.
WWF___	Wright Field, Dayton, Ohio.	ZE_____	San Jose, Calif.
XA_____	Allentown, Pa.	ZF_____	Springfield, Mo.
XN_____	Austin, Tex.	ZH_____	Shreveport, La.
		ZK_____	Santa Fe, N. Mex.
		ZN_____	San Antonio, Tex.
		ZP_____	St. Paul, Minn.

APPENDIX X

PHONETIC ALPHABET

Letter	Spoken as	Letter	Spoken as	Letter	Spoken as
A	AFIRM	J	JIG	S	SAIL
B	BAKER	K	KING	T	TARE
C	CAST	L	LOVE	U	UNIT
D	DOG	M	MIKE	V	VICTOR
E	EASY	N	NEGAT	W	WILLIAM
F	FOX	O	OPTION	X	XRAY
G	GEORGE	P	PREP	Y	YOKE
H	HYPO	Q	QUEEN	Z	ZED
I	INTER-ROGA-TORY	R	ROGER		

Numeral	Spoken as	Numeral	Spoken as
0	ZE-RO	5	FI-YIV
1	WUN	6	SIKS
2	TOO	7	SEV-VEN
3	THUR-REE	8	ATE
4	FO-WER	9	NI-YEN

INDEX

INDEX

INDEX

INDEX

[A. G. 062.11 (1-24-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

DISTRIBUTION:

D1, 2, 7, 17(3); B1, 17(2); R1, 17(3); Bn 1(10), 11(3); IC 11(5).

U. S. GOVERNMENT PRINTING OFFICE: 1941

For sale by the Superintendent of Documents, Washington, D. C. - - - - Price 10 cents